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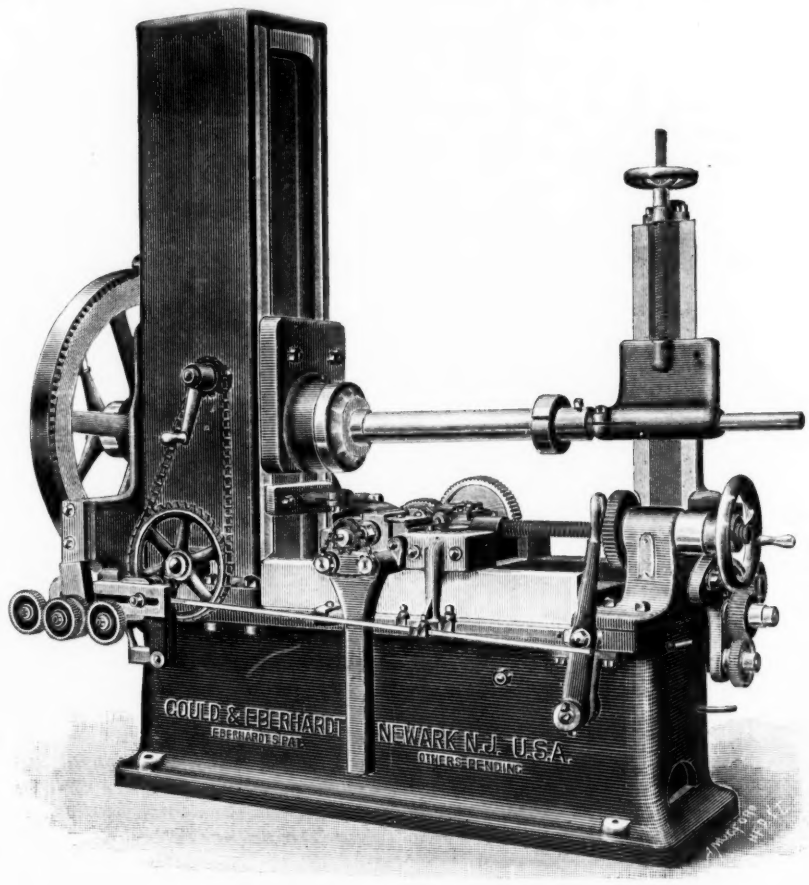
Large Automatic Gear Cutter.

We give on this page an illustration of one of the latest designs of automatic gear cutting machines built by Gould & Eberhardt, of Newark, N. J.

This machine is for cutting spur gears only, and will cut them up to 84″ diameter, 20″ face, and 3″ circular pitch. Provision is made for the use of two cutters when desired, which are placed on the same arbor side by side, one being a roughing cutter, while the other finishes. A comparison of this with the other machines built by the company, which we have illustrated from time to time, shows that while the same general features have been retained, there have been some modifications, which seemed to be called for by the increased size of the work to be done. It will be noticed that there is an outer bearing for the end of the work arbor, which helps much in holding it steadily for the heaviest cuts. The carriage which carries the cutter arbor is not only made exceptionally heavy, but is fed to the cut by a large screw shown, which is directly in line with the cutter, where it is most effective and imposes least wear on the sliding surfaces. This screw does not turn, but passes through a nut which is formed in the sleeve, to which the hand-wheel and feed gears are attached. Provision is made for moving the cutter arbor on the saddle to bring the cutter under the center of the gear, and there is a gauge which is attached to the carriage, that indicates when this position is precisely attained. Cutters up to 7″ diameter can be used.

The arbor is driven in the same manner as that of the smaller machine illustrated in our issue of Nov. 13, page 2, the gears for this as well as for the feeding and dividing mechanisms being made amply strong for the work. Chips are automatically removed and deposited at the side of the machine, where they may be caught in any suitable receptacle. The machine, like the smaller sizes, is wholly automatic, and requires no attention beyond what is required for any machine to keep it in good order, and the changing of the work when finished. The machine weighs about 7,000 pounds.



LARGE AUTOMATIC GEAR CUTTER.

Internal Grinding Attachment.

In our issue of September 18 we illustrated and described the Brown & Sharpe Manufacturing Company's new improved universal grinding machine. Amongst the other detail cuts presented at that time was the sectional view of the internal grinding attachment which appears on this page, but which at that time we did not enter into a detailed explanation of. As this is entirely new, and we have had inquiries from some of our readers who are interested in the subject and wish to know the particulars regarding the construction of the device, we have considered it advisable to give a detailed explanation.

In the attachment heretofore used for internal grinding, a solid arbor or wheel spindle was used, which was not only restricted as to its diameter, but had also to be supported by a journal bearing which was at a considerable distance from the wheel. As this bearing had to bear its share of the pressure caused by the belt tension in addition to that caused by the wheel upon the work acting with considerable leverage, it had to be of such diameter as to make it impossible to attain such speed as would make the wheel efficient; and not only this, but any play which there might be in the bearing was multiplied at the wheel, owing to its distance from the bearing.

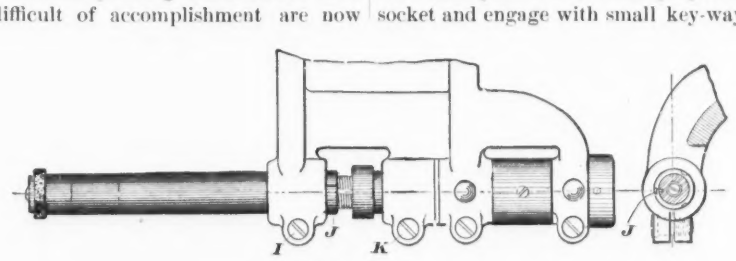


Fig. 1.

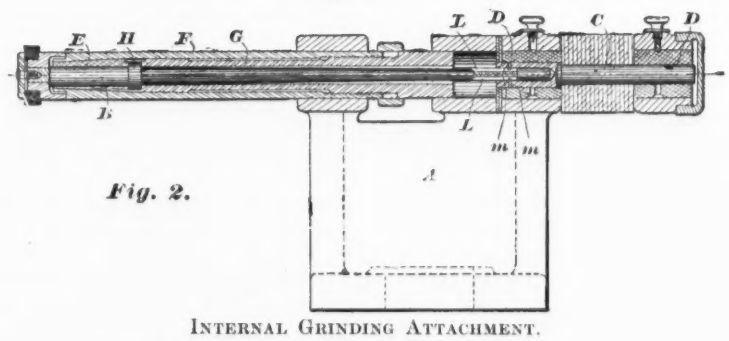


Fig. 2.

INTERNAL GRINDING ATTACHMENT.

The object in the present construction has been to overcome all these difficulties, and so thoroughly has this been accomplished that jobs of internal grinding which before were very difficult of accomplishment are now easily done, the efficiency of the wheels having been very much increased.

Referring to the engravings, *A* is the frame of the attachment, which, as will be seen, affords four points of support for the spindles and their boxes, which are secured in place by the binding screws, two of which are designated by the letters *I* and *K*. *C* is a short spindle, which is supported in two independent boxes of its own, between which is the driving pulley, as shown. The left-hand end of this spindle is slightly enlarged and bored out to form a socket into which the rear end of the grinding spindle enters, but does not fit closely, being driven only by means of the two small pins *m m'*, which project into the socket and engage with small key-ways *L L*, which are formed in the end of the grinding spindle, as shown. The grinding spindle is supported by two tubes *F* and *G*. *F* is threaded internally at its right-hand end, while at the left its bore is tapered, as shown, to receive the bearing *E*, which, by longitudinal cuts made in it, one of which passes entirely through, can be adjusted to the journal *B*. This box being inserted in its place, and the grinding spindle put through until the collar *H* comes against the rear end of the box, the tube *G* is then inserted, and by means of the external thread which engages with the internal thread of tube *F*, is screwed in until its end comes in contact with the collar and advances the box until the bearing is sufficiently close for running. The recessed collar shown is then put on the projecting end of the grinding spindle, this being so formed as to protect the bearing from dust, and to this, by means of the screw and washer, the wheel is fixed. The whole is then put in place, as shown, and the binding screws, *I* and *K*, Fig. 1, tightened, the depth of the socket in the end of the spindle *C*, and the length of the key-ways in the end of the grinding spindle, allowing some latitude as to the distance the wheel shall project. A sliding collar covers the threads at the juncture of the two tubes, adding to the neat appearance of the device and preventing the entrance of dust to the spiral slot, or oil duct by which oil is conveyed to the journal *B*.

By this construction it is seen that the spindle upon which the pulley is placed is independent of the grinding spindle, and need not be disturbed when the latter is moved. The pull of the belt in no way affects the grinding spindle, and a bearing is provided, which is as close to the wheel as it is possible to put it and where it will do the most good. This enables the bearing to be reduced in diameter to such a size that it is entirely practicable to run the wheels at speeds which make them efficient.

The attachment is made in various sizes, so that it can be adapted to the work to be done, and, we understand, can be fitted to the older styles of machines as well as to the improved grinders.

Human Curiosity, Mechanical Reporting, and a Late Engine Wreck.

BY PETER H. BULLOCK.

A scene of wreck and confusion, no matter by what caused, is always a source of attraction to a crowd. There seems to be an innate longing to see and speculate upon ruin and disorder, whether caused by the letting loose of natural forces or from the miscarrying of human intentions. Not many years since a score of train loads of people were carried two hundred miles into the heart of the White Mountains, in New Hampshire, to see the wonderful effects of a land-slide, whereby literally a million tons of material had been swept down a mountain side through a narrow gorge, and out onto a plain. The same desire to see ruin attracts people to fires and railroad disasters, where, by some mischance, forces that are usually under control become unmanageable, and work destruction to fine architectural and mechanical constructions. Mechanics may not be supposed to be less human than the rest of mankind, and in addition to their natural curiosity to see the ruin of material, they usually have a desire to know the reason why a thing happened, and an avowed cause that will satisfy the rest of the crowd may be entirely unsatisfactory to them. That a "crank-pin key got loose, letting the

sand onto the crown-sheet of a locomotive," might pass with some people as the cause of a railroad accident, but there would be others that would want a more explicit reason. Owing to such absurdities in the press reports of accidents to boilers and machinery, most engineers are getting to put little confidence in them, except so far as it may be a fact that a mishap of some kind has occurred. It is to be hoped that the number of engineers who believe that there is any mystery about boiler explosions or engine wrecks is growing less, and the sooner this species is extinct, the better it will be for the community at large, especially if their places are filled by men who know that certain causes produce certain results; that material of a certain strength will resist certain pressures, and that so long as natural laws are understood and observed, there will be no mysterious accidents.

But the millennium has not yet come, and the reporter does not get to the scene of an explosion much ahead of the "competent engineer" who prattles of "low water" and "globular absorption of heat," or some other mysterious cause for the accident, and estimates that there must have been "several hundred pounds pressure to have thrown the parts so far."

Some years since, the writer was within hearing of a locomotive boiler explosion, and was on the scene before the dust had settled. The whole front end of the boiler had been blown away, the forward sheet and smoke arch being thrown several hundred feet up the track, while the rest of the engine had shot backward, and the only injury the men in the cab had sustained was from being thrown about when the tender struck some cars, against which it was thrown by the recoil, the engine not being derailed by the explosion. The usual mysterious reasons were given—low water and the sudden generation of gas. Somebody had heard a low humming in the boiler, which must have been the early symptoms of disaster. Others said it was "dead water" in the front end that suddenly turned to steam, else the men in the cab would have been blown to atoms. Upon examination, the forward girth seam was found to have been poorly spaced, and probably the drift-pin had been used to excess. There was an old fracture between four holes on the inside sheet, and the iron that was newly broken was very bright, brittle and crystalline.

Now, what need of mysterious reasons when such plain every-day evidence was at hand? The weak spot was on top, and the fracture followed the line of rivets down each side; that made the force of the explosion forward, backward and downward, and was why the engine kept the track. The opening afforded ample relief, and the back end had no occasion to explode, but was violently shot backward by the recoil. No mystery, nor cause for any. Original bad work, subsequent lack of examination; result, explosion.

A few weeks since, a fine Corliss cross compound engine in the Lynn electric light works was badly wrecked, and the daily papers gave their usual (to mechanics) humorous accounts of the accident: "The electricity short-circuited the governor; the electrician shut off the current to stop the fire, and the full power of the engine ran away with it."

"There was a vacuum in the condenser that pulled the engine with terrific speed to its destruction," etc.

After reading so many conflicting and unlikely reports, and wishing to see the scene of the wreck, and learn the cause thereof, the writer visited Lynn, met the courteous superintendent and engineer, and was freely given all the information in their possession. The facts seem to be about as follows: The engine was comparatively new, in good condition, well taken care of, and was running satisfactorily up to the time of the accident, which occurred at about 1 A. M., when the least power was being used, and no other engine in the plant running. At this time a fire was discovered in the wire tower, and efforts made to extinguish it, the engineer on duty first assisting, and then going some distance across a large room filled with electrical machinery, to the boiler-room to blow the fire alarm whistle, while the electrician was to ring in a fire alarm from the nearest box. Suddenly the premises were in darkness, either from the wires becoming crossed or the current being shut off, and very soon the wreck began, pieces of the fly-wheel carrying away both walls and the roof of the building. Self-preservation, which is the first law of human nature, prompted those in the room to make hasty exits from among the crash of matter. That something must have happened to the valve gear is certain, but just what that was will perhaps never be known. At least no one who is familiar with the Corliss valve gear will believe that an engine of this class can be wrecked from racing, caused by the load being suddenly thrown off, for if it is in good condition, as this one undoubtedly was, the governing apparatus will operate to prevent any steam being admitted to the H. P. cylinder from the boiler, or to the L. P. cylinder from the receiver long before a dangerous speed could be acquired. Especially is this true where the admission and cut-off of both cylinders is controlled by the regulator, as in this case, and the fact that there was a good vacuum in the condenser, and that it was produced by an independent air and circulating pump, does not make any difference so long as the regulating apparatus is all right. The fact that the exhaust pipe of an engine is attached to a condenser in which a vacuum is maintained, does not prove that the engine can run unless something is admitted on the other side of the piston; for, if there is not, the vacuum is as perfect one side as the other, and the engine must come to rest. That the H. P. valves of the wrecked engine leaked much, if at all, is not claimed, and therefore if the L. P. cylinder had had a fixed cut-off beyond the control of the governor, the leak must have been excessive in order to pass steam enough to the receiver to allow the low-pressure engine to run away with the other.

Any theory of electrical cause is also absurd; there was no other engine running at the time in that plant, and probably no other in the city; neither is the location of the tower such that anything could fall from it onto the engine. The most probable theory seems to be that the governor balls were fouled by the main belt, which is said not to have been very tight, yet enough so to properly do its work. A straight line drawn from the top of the fly-wheel to the top of the driven pulley was 18" above the usual plane of rotation of the balls. The crank-shaft is comparatively short, substantially all the space between the foundations being taken up by the 40" fly-wheel. The engine turned under, bringing the delivery, or loose side of the belt on top, as the driven shaft was in the rear, or behind the cylinders.

The engine may have been doing 300 H. P. just before the fire, and when this was suddenly thrown off, the speed would naturally increase, and the balls raise to a higher plane than, perhaps, they were ever before, and the belt would begin to sway and undulate until it might, and quite likely did, come in contact with the revolving balls, disarranging the releasing gear, whereby some part of it failed to perform its intended function, and the engine raced to destruction.

It is quite possible that, everybody's attention being attracted to the fire, and giving the alarm for it, that in the darkness and amid the noise of the steam whistle, no one noticed the increased speed until things began to go to pieces.

There is one thing about this wreck that can be profited by, although perfectly well understood before, and that is that steam is about the best fire extinguisher there is known, for when the boilers had emptied their steam into the room through the broken pipes, not a vestige of fire was to be seen. Another thing that will come to the minds of most engineers is that it is not safe for the one in charge to get too far away from a large engine, and especially when there is trouble with any of the driven apparatus.

That so serious a wreck could occur and not disable the whole plant is marvelous. The other engines and uninjured shafting were got in order for the next night's run, which fact reflects credit on those in charge.

Tools for Brass Work.

Continuing the subject of brass shop tools and appliances, we find many tools, ingenious in their way, but suited for their peculiar work and no other, yet capable of forming the basis for other tools that may be devised as necessity calls.

Believing that many ideas can be gained from seeing these special tools and fixtures, which may be useful in similar cases, or by alterations be used in the different kinds of work, I will endeavor to show a few which may prove of interest to your readers.

In common practice, the Fox lathe worker has gauges of brass—tapped or chased the right size, and these are used to chase to—*i. e.*, the work is chased to fit these gauges.

These gauges wear from continual use, and so the work does not fit where it belongs, and then the gauges get overhauled—sometimes they are to blame and sometimes not; but all this time adds additional cost to the manufacture. So we made the hand die shown in Fig. 26, and obviated the difficulty.

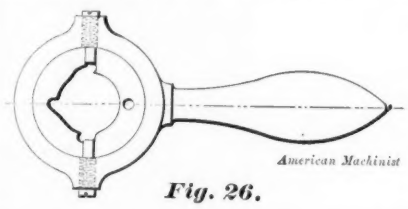

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Fig. 26.

The work is chased about to size, and then, holding the die in the right hand, the lathe hand runs it over the thread and brings it down to size—no excuse for the gauges wearing; if the work doesn't fit, we know the die hasn't been on the work—at least not all the way on. Nor is the *size* the only object, for the *shape* of thread has much to do with the fit, and chased work is rarely the same.

The thread tools (I am speaking of single-point tools now) are ground by the "eye," and then set by the "thumb"; holding the tool point down on the thumb nail, they squint across and guess it is all right, and set it the same way—hardly the way for accurate work, even after years of practice.

The only Fox lathe man I ever saw grind a thread tool to gauge evened things up by setting it "squintwise" across the thumb nail.

The die not only "sizes" the work

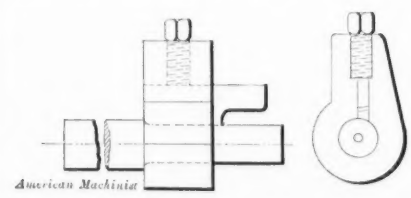
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Fig. 27.

chased, but straightens the thread up in shape as well, unless, of course, the angles are too far away from 60°—have seen some that were about 45°, and of course it can't make these right unless they allow quite a cut for the die; it will not cut any "on," am sorry to say.

In practice I leave about one or two-hundredths of an inch for the die.

A few points about the die will be in order, though the cut makes it quite plain.

I first turned up mandrels and chased the threads one size on each end, to standard size, to be used as reference gauges; then bored and chased the die rings to screw on, and turned the outside and faced them.

After drilling the holes for the cone point screws, and those parallel with the thread for cutting edges, the ring is sawed at the side edges, and filed up the same as any die.

There should be either four or eight cutting edges, so as to have one cutting edge top and one bottom, as the "lining up" is all at these points.

Instead of this way of making, however, the die ring can be turned up and put in the holder (which has just been bored and is still in the chuck, and has been previously drilled and tapped for the side screws) and bored and chased in place.

It matters not which way they are made, the office they perform in keeping work to a standard is what we are after.

We all know the tendency of tools in general to follow a "cored" hole, and that, could this be obviated, it would admit of having much work cored that is now cast solid.

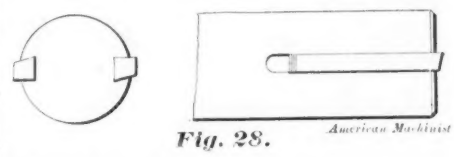
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Fig. 28.

The general plan in such a case is to get the core true, and turn the outside true with the bore, which is oftentimes inconvenient, to say the least.

A single point tool, such as a Fox lathe back head tool, is the best means for boring a cored hole when the case demands that the hole must not be followed.

This is impossible in much work, on account of expense and inconvenience when the hole is very deep, and we must resort to the turret lathe. The boring tool then, to be successful, must be as near a single-point tool as possible, but as we usually take the full cut (or nearly so) at once, we use the next best form of cutter, which I have found to be the flat cutter—two points instead of one.

I do not claim this form will not follow, more or less, but have found it to be more satisfactory for a roughing cutter than the round bar.

I make the thickness proportionate with the work, varying from $\frac{3}{16}$" to $\frac{1}{2}$" usually.

This brings us to Fig. 27, which was designed to mill work so that the outside must be true with the bore, and it accomplishes its purpose well.

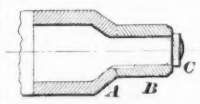

Fig. 29.

We first bore the hole with flat cutter as described, then follow with the guide shown, and the guide, just filling the bore, eliminates all chance of its "running out," and the outside is milled, faced and chamfered with the cutter shown.

If it was desired to have the bored hole sized out exactly, wide bearing cutters might be inserted in the bar, and, by having not over .02 to cut out, still mill very true, but when the bore is to be tapped, the size need not be exact.

A point of practical value may be given here, and that is, where a piece of work is threaded both inside and out on the same end, run the die on first where possible; for, the die being apt to "squeeze" a little, the tapped hole is not altered in size.

A little forethought in similar cases will save much work after the pieces are all cut.

After having the piece bored and milled true, the tap should not start in sideways, as they are so apt to do on brass, so we guide them whenever possible.

One of the sectional taps shown in my first paper on this subject shows the manner of guiding taps, the guide or "tit," as it is sometimes called, usually being the same size as the tap, *less the thread*, though different work calls for different applications of the same principle.

By this method the holes are tapped true as well as bored in the same manner, and they have the additional advantage of detecting any decrease in the size of the boring cutter due to wear, by refusing to enter the bored hole.

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Fig. 30.

The die can be guided by boring out the first two or three teeth from the face, except, of course, where it is required to thread close to a shoulder, in which case the guide could be internal. I have described these operations just the reverse from the way they should be performed, *i. e.*, die first, then tap.

Sizing cutters must, or should be adjustable, and after much experimenting, we find nothing better than the much used form shown in Fig. 28.

We formerly used this for the roughing or first boring bars also, but have abandoned it for the plain flat cutter mortised through the bars for the larger sizes, and for the sizes up to 1¼", the plain flat cutter before described.

The roughing bar must stand much hard service in the scale of the brass castings, especially in the long cored holes, where the sand seems to burn in and rival the emery wheel in grinding qualities; this makes frequent renewals necessary, and it is much cheaper to insert a plain cutter in a bar than fit dovetailed ones.

Much work and time in the tool-room may be saved in many cases by making everything in the cutter line of some standard size steel, so that fitting is unnecessary.

Many seem to think that only rough work can be done on the turret, and especially is this true of Fox lathe men; but with proper appliances and tools, and run by a man who is careful and intelligent, it can produce work that is a credit to any shop.

In making a valve seat, the first requirement is that it shall be true and smooth, and this we secure by using the finishing tool shown in Fig. 29.

The system of guides is here shown once more, and here as elsewhere proves its usefulness by producing a practically perfect seat.

The seating tool *A* is really a hollow mill or rose reamer, held from turning by the key as shown, and the cutting edges are made of the required angle as shown.

The guide *B* (or in this case cutter also, for it is used to merely size the passage properly—boring not over .02") is held in place by the check nut *C* on the end, and kept from turning by the same key that holds the main cutter.

By tightening this check nut both cutters, or cutter and guide, as the case may be, are tightened to place, and the key takes all the strain, so we use a thin nut and fine thread as shown.

The advantage of having this tool in two parts must be apparent; for by removing the cutters, the seating tool may be ground or oil-stoned at will, and the forward cutter likewise with a satisfactory result, impossible were it made solid.

By grinding every part in a similar manner, it is very easy to obtain a valve seat true with all the other parts, and to avoid the cramping that is so often done.

It often happens that we wish to tap coarse square threads in brass, and do it all at one cut.

The taper tap—*i. e.*, the tap with the front end tapered off to start easily, is not always satisfactory—it has a tendency to "jam" sideways, and to clog up quite badly.

We use a "step" tap (Fig. 30), considerably, and find it an improvement for much of the work, though not a panacea for all the ills that befall this kind of work, by any means.

When made correctly, the step tap is practically a series of straight taps all cut on one bar of steel.

First comes a guide—*i. e.*, just the size under the thread—then a thread that is one-quarter or one-fifth, or even one-third of the full depth of the completed thread.

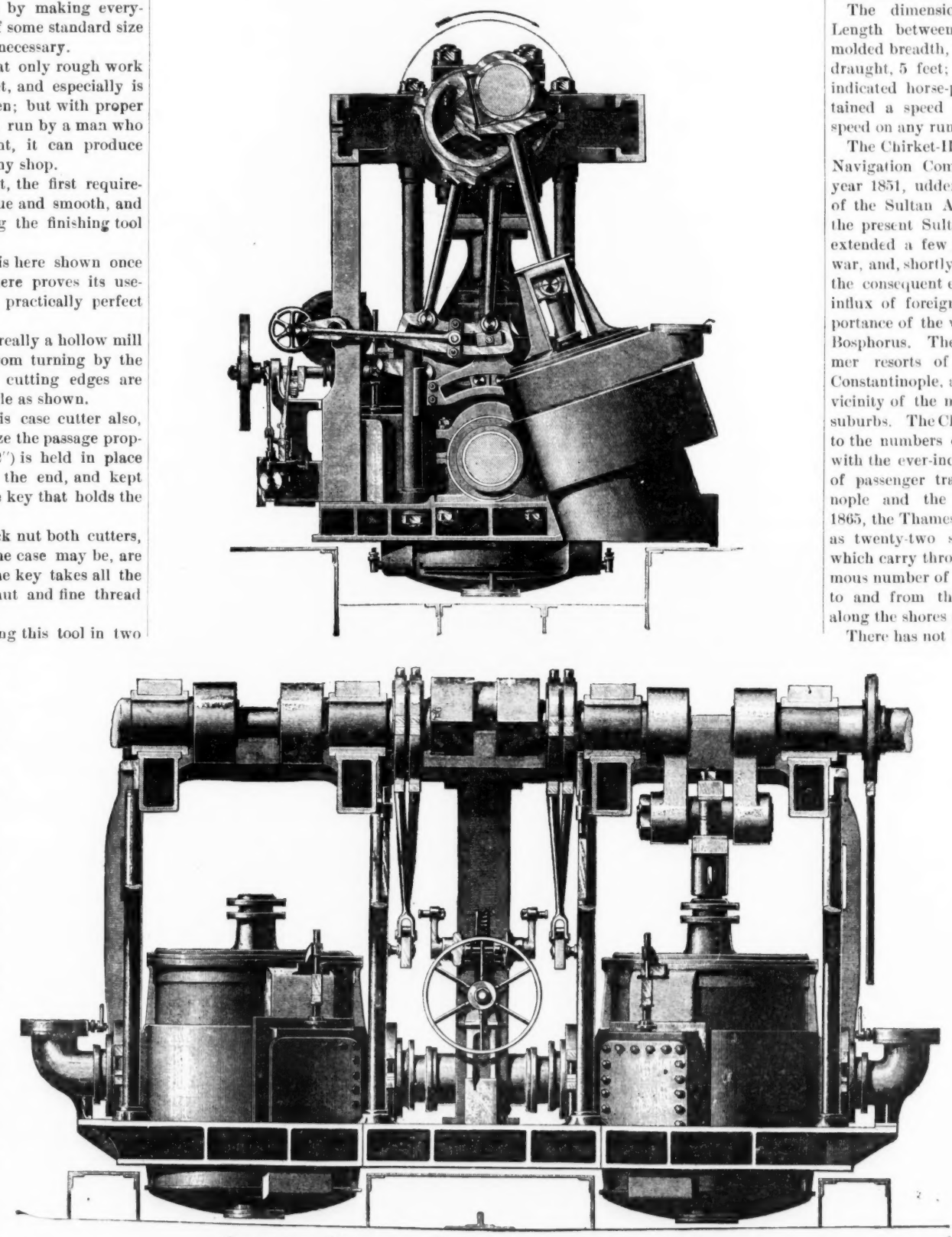
The next step cuts the same amount also, making two-thirds or half the depth, as the case may be, and so on, having as many steps as the depth of the thread requires.

Where possible, without making the tap too long, each "step" should be about the length of the articles to be tapped. By this means one step just about finishes cutting as the next one starts in, so keeping the strain on the tap about the same during the entire cut.

I say "about," because the increasing leverage as the diameter increases adds to the strain so imposed, which can, however, be rectified if desired, by decreasing the depth of cut as the diameter increases.

Care must be taken to give the leading edge of teeth on the front of each step a good cutting edge, so as not to bind or jam.

In any square or bastard thread tap the *sides* as well as the *bottom* of thread should be "backed off" to prevent friction. This is too often neglected, and is a fruitful source of broken taps.



OSCILLATING ENGINES FOR STEAMERS RUNNING ON THE BOSPHORUS.

"Papa, give me a dollar."

"What for?"

"Oh, just to own."

"All right, Johnny. You can own this dollar I have in my pocket, but I'll play I'm a trust company and keep it for you."—*Harper's Bazar.*

About 300 men in the employ of the Union Pacific Railroad, at Omaha, Neb., have recently been discharged. This comes from a general order to reduce the working force.

Oscillating Engines for Steamers Running on the Bosphorus.

We give two views of a two-cylinder oscillating engine for one of the two steel paddle-wheel passenger steamers recently built by Messrs. R. and H. Green, Blackwall, for the Bosphorus Steam Navigation Company, or, more correctly, the Chirket-Hairieh of Constantinople. These vessels have proved most successful, and have given eminent satisfaction, both to the directors and the traveling public in Constantinople. The engines are of the simple expansive type, with cylinders 37 inches diameter and 3 feet stroke. The framing and principal moving parts are of an unusually massive description, being made to meet the requirements of the passenger traffic on the Bosphorous, which is exceptionally heavy. The paddles are fitted with feathering floats, and the crank-shafts, paddle shafts, piston rods, working gear, levers, etc., are constructed of steel. The engines are fitted with steam starting engines connected with the link motion, and this arrangement offers great facility in executing the frequent orders from the deck.

A surface condenser, fitted with a centrifugal pump, condenses the exhaust steam, and the air pump, which is worked off the main engine, is fitted with brass valves for the purpose of enabling the feed to be used at an economical temperature. The feed and bilge pumps are situated at the wings of the engine, and receive their motion from eccentrics on the paddle shafts. A Worthington feed engine is arranged in the engine-room for the purpose of supplying the boiler with water in case of need, and is also to be used as a bilge pump.

The boiler is 13 feet 3 inches diameter, by 9 feet 8 inches long, and has a steam dome; it is of the circular return-tube type, constructed of steel for a working pressure of 50 pounds per square inch, with iron tubes 3¼ inches diameter. There are four furnaces 3 feet 2 inches diameter, and the back flues are separate. There are ample water spaces and manholes for cleaning purposes.

The dimensions of the steamers are: Length between perpendiculars, 165 feet; molded breadth, 21 feet; depth, 10 feet; load draught, 5 feet; and with an average of 580 indicated horse-power on the trial, they attained a speed of 13.6 knots, the highest speed on any run being as high as 16 knots.

The Chirket-Hairieh, or Bosphorus Steam Navigation Company, was started in the year 1851, udder the immediate patronage of the Sultan Abd-ul-Medjid, the father of the present Sultan. Its traffic was largely extended a few years later by the Crimean war, and, shortly after peace was proclaimed, the consequent extension of commerce and influx of foreign capital increased the importance of the villages on the shores of the Bosphorus. These became the favorite summer resorts of the well-to-do classes in Constantinople, and those in the immediate vicinity of the metropolis became populous suburbs. The Chirket-Hairieh rapidly added to the numbers of their fleet, to keep pace with the ever-increasing demand for means of passenger transport between Constantinople and the Bosphorus shores. Since 1865, the Thames yards have built as many as twenty-two steamers for the company, which carry throughout the year the enormous number of ten millions of passengers to and from the thirty villages scattered along the shores of the Bosphorus.

There has not been a single case of serious accident on the records of the company, and this speaks most highly of their wise management, and the excellence of the *personnel* of the company. A very considerable amount of their success is due to the exertions of Mr. H. H. Iskender, the company's able secretary, who, besides organizing an admirable system under which the steamers run, has personally superintended the construction of all those built since 1868, including those that have just been completed.

The illustrations and foregoing description have been taken from the *London Engineer.*

A Danger Signal.

We have before commented upon the conditions found in the town of Pullman, and have said that while we did not doubt the good intentions of the founder and owner of the town, the tendency there was not to develop the best type of citizens for a republic such as ours.

The following editorial, which we clip from the New York *Commercial Advertiser*, may be slightly overdrawn in some points, but we are of the opinion that it contains much food for thought, and may well be studied seriously by those who think that social regeneration is to be brought about by coddling of the weaker instead of simply giving them full and complete justice—an equal chance in the race of life, and then

letting them care for themselves and their own affairs:

Promptly following the decision of the Interstate Commerce Commission in their favor, comes the announcement that the Chicago packing-house interests are to found, upon the southern shores of Lake Michigan, a city of pork packers. The new town will undoubtedly be patterned after the very successful colony of Pullman, and the country whose name stands for liberty in the world will see a second experiment of the extremest type of State socialism. In Pullman, the people are happy and prosperous; the streets are clean, well paved, and well lighted; the rents are low and the taxes moderate. Yet in Pullman magna charta is tacitly ignored. The State—that is, the Pullman Palace Car Company—owns the land, paves the streets, builds the houses and stores, furnishes the light and manages the government, which includes mainly an infinitesimal police force, and a diminutive and empty jail. The American right of choosing rulers is here remitted to the limbo of theory; in practice, the company names the government, and the "people" elect it or leave town.

A love of truth compels the admission that, for their own petty prosperity, the people of Pullman have profited by the dynasty under which they live. This is due, however, not to the theories upon which the city is founded, but to very different causes, one of which is the remarkable administrative sagacity of the existing generation of Pullman magnates, and another the fact that residence in Pullman is at present entirely optional, so that if the company abuses its powers its constituency, which is also its working force, can step across the line and re-enter the domain of American institutions.

This is equivalent to saying that the duplication of Pullmans is a menace to the country. There is no reason to hope for an Armour dynasty as moderate and wise and capable as is the Pullman plutocracy. The restraining influence now exerted by the fact that the workmen are free to depart, will weaken, too, with time and with the growth of similar institutions throughout the country. But, above all, the existence of such institutions is to be feared on account of their enervating effect upon the political consciousness of the country. The training school for citizenship, without which American civilization cannot continue, is unknown to Pullman. Political thought, political feeling, and political action are there in local affairs impossible. The child born to day in Pullman will not be an American if he comes of age in Pullman. He will be as unfit for naturalization as the Italians or the Chinese.

In the face of this, the economic advantages are trivial. The latifundia of the Roman empire, great estates economically administered like that of Pullman, sapped the life-blood of the Roman people, and contributed to its downfall. Yet the pure economist could find little fault with them. In the domain of political science, political economy is but a small factor. It treats of wealth; but statesmanship must deal with men.

Shop Notes

The Mason Regulator Company, of Boston, has its shops at Dorchester, which is a short distance out from the city. The shops are new, having been occupied only about one year, and are not large, though the distinction is claimed for them of being the largest shops in the country devoted exclusively to the production of such goods as theirs. Their work is pressure regulators of various kinds, damper regulators, air-brake regulators, pump regulators, and in fact regulators for about everything, except perhaps watches and clocks.

FINE BRASS WORK.

The work is almost entirely of brass, and, in these days of "cheap and nasty" brass work, is especially noticeable for its workmanship, which is of the highest order.

One does not talk long with Mr. Mason before discovering that he is an enthusiast on the subject of having things just right, and the shop over which he presides is a model of good order, neatness and cleanliness. Not many special fixtures are to be seen aside from those used in most shops where brass is worked, but dependence is put mainly upon the best machine tools—Fox and turret-head lathes, etc.—and first-class mechanics. Standard sizes and interchangeable parts are maintained by the use of gauges.

In most of the specialties made here, there are one or more pistons which move within a cylinder, and special pains are taken in boring and reaming these cylinders so that the pistons will interchange from one to the other, and have a smooth and uniform motion, easily effected by any change of pressure which may take place. Solid reamers are used for finishing these cylinders, and they are made and fluted in the ordinary way, but are not backed off, the necessary clearance being obtained by a very slight oil-stoning, and by making the reamers taper—about .01" in a reamer 8" long—the entering end being the largest. It is found after considerable experimenting that this gives the best results for the class of work they are doing, the reamers holding their sizes well, and, as we can say from a personal inspection, doing remarkably good work. It is to be remembered, however, that they are used by good mechanics who know what a reamer is for, and are cared for and kept in order by a man who takes an interest in them and the work, Mr. Thos. F. Kean, the foreman of the shops.

A MODEL ENGINE-ROOM.

Any one interested in seeing what can be done in the way of fitting up a small engine-room in such a way as to be attractive, and so that the machinery comes very nearly taking care of itself, will do well to visit this one. Everything is bright with nickel, paint and varnish, and, like the rest of the establishment, is as clean as it is possible for a place to be. Every modern improvement and appliance is to be found in it, which can in any way tend to make the plant more complete.

There is a certain color for the painted portions of machine tools, which has come to be so generally adopted as to deserve the name of the standard, perhaps. We are not going to dispute the general opinion that it is the best possible color for the purpose, but will say that some of those who feel certain that it is, might entertain some doubts about it, after an inspection of the machinery in this shop. It is painted a very deep and rich vermilion, and varnished. Kept clean as it is here, it certainly looks well, though it is much more expensive, probably, than the regular thing.

STERLING ELLIOTT'S SHOP.

Sterling Elliott's business in the manufacture of bicycles has so outgrown that of machine tools that the establishment at Newton, taken as a whole, is much more a manufactory of "wheels" than a machine shop, the very considerable additions which have been made to the plant recently, being devoted entirely to the production of his "Hickory" bicycles. At the time of our visit the bicycle business had practically closed for the year, and the most of the work that was going on at the time in connection with it was the building of a model machine which is to be brought out next season, and which he declares will be the best, the handsomest and the highest priced machine on the market. The wheels of this, like the one built at present, will be of wood, but, unlike the other, they will be varnished in the natural wood, the metallic parts nickel-plated, and there will be ball bearings throughout.

REFINEMENTS IN WHEEL MAKING.

To those whose only idea of the construction of a wooden wheel is derived from the practice of the wagon maker, the methods pursued here are something of a surprise and a revelation. Of course, for the purpose of a bicycle, no wheel that is the least clumsy in appearance, or heavy, will answer. It must look light, and be light, and to attain this the stock must, in the first place, be chosen with that special object in view, and then the method of manufacture must be such as to get the greatest possible strength out of it. A few instances, showing the nature of the methods adopted, will suffice to give an idea of what the results are, besides being in themselves instructive.

In the first place, for the seasoning of the wood of which the spokes are made, the micrometer caliper is used to determine when the process has gone as far as any benefit is to be derived from it.

The pieces of wood which have been previously formed to the approximate size and shape, are placed in the drying room, which is heated by steam pipes, and certain representative pieces are selected from different parts of the pile, and measured by the micrometer across the grain near one end. The date and hour of measurement, with the size in thousandths of an inch, is marked on each piece so measured with a pencil, and at frequent intervals these pieces are again measured, and they are kept here until the measurement shows that no further shrinkage will take place.

One result of these measurements has been the acquirement of considerable knowledge regarding the shrinkage of wood under such circumstances, which is believed to be new, and at any rate is quite interesting. Amongst other things, it has been demonstrated that during the first twenty-four hours after the wood has been placed in the drying-room (which is the time often allowed by wheel makers for the drying process), the wood actually swells, and, if removed at that point, will shrink with the subsequent seasoning which will naturally take place, this fact accounting for many loose spokes in carriage and wagon wheels. Mr. Elliott concludes from his experience, that, owing probably to differences in the condition of the timber, and in the atmospheric conditions, no time can be given as the correct one in which to season wood for such purposes, and that the only right way is to season it until further seasoning can do no good, and this point is determined in the manner in which the machinist would naturally determine it, and in which the wheel maker would, in all probability, never think of determining it, *i. e.*, by the use of the micrometer caliper.

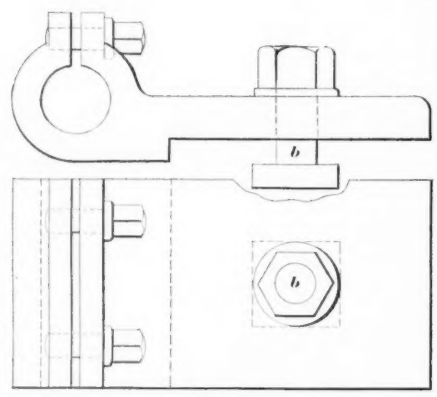


Fig. 1.

In forming these spokes, the spoke-turning lathe (which is a special adaptation of the Blanchard lathe) is entirely discarded, and they are formed in such a way that the device by which they are reduced to the proper thickness automatically measures the strength of the piece, and gauges its thickness accordingly, so that, as the spokes come from the machine, they will vary in size sufficiently to give them the same resistance to transverse strains. This is accomplished by running the pieces through an ordinary universal wood-worker or planer, three of the pieces being placed side by side in a fixture which supports them at the ends only. Above, and as close to the cutters as they can be placed, are three springs which bear down upon the pieces and spring them slightly, so that the side acted upon, instead of being straight, is slightly full in the middle, and, as the springs are adjusted to exert an equal pressure, those pieces which are most easily bent will bend the most, and will be thickest, the size of all the pieces being exactly gauged to give the same resistance to bending stress. This will be recognized as ingenious, and is a fair sample of the refinements which have been introduced all through the manufacture. To mention another instance, the usual practice of putting a wheel together, and then chucking it as true as convenient by the rim to bore the hub, is reversed, and the hub bored first, after which the rim is turned true for the light steel tire, to which the rubber tire is secured.

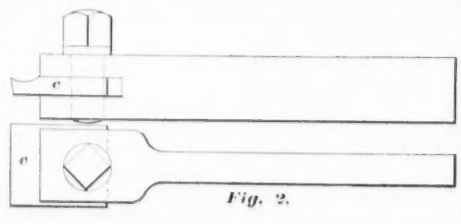


Fig. 2.

In the machine shop, which is devoted mainly to the production of drill presses, book binders' stitching machines, and various small tools shown in Mr. Elliott's famous catalogue, nothing is to be seen except what is usually found in the "Simon pure machine shop," where good work is done. The lathes are provided with a device for keeping the chips off the floor, and utilizing the floor room, which seems to be worthy of more general adoption. An illustration of it was published in this paper May 27, 1882.

BRAINARD MILLING MACHINE CO.'S SHOPS.

The Brainard shops at Hyde Park have felt the influence of the present busy times amongst the tool builders, and, like most of the rest of them, they have been enlarged to give capacity sufficient to keep up with orders. An addition to the original shop has been built, which is about equivalent to a building 25 by 100 feet, and there is also a new building, which was erected for storage purposes, but has been appropriated as a shop. This is 75 by 50 feet, two stories high, and is now pretty well filled with machine tools, which are all in use. This building has all modern improvements, including a force blast heating system by Sturtevant.

A good example of the use of spiral gears is to be seen here in connection with the transmission of power for an elevator. Two shafts at right angles to each other are connected by spiral gears 8" diameter, 4" face, running 180 turns a minute. The gears were cut in the shop on a machine built by the company, and are working very satisfactorily.

The foreman of the machine shops, Mr. J. F. Ross, is one of those who were interested in the "Grindstone *versus* Emery Wheel" discussion that was going on in these columns some time ago, he being a believer in the grindstone for such grinding as is done on lathe and planer tools. The grindstones used here are well mounted, kept in order, run at a speed of 900 feet per minute, and are found to be entirely satisfactory, though many emery wheels are used for various other kinds of grinding.

HOLDERS FOR BORING TOOLS.

Mr. Ross is also a believer in the practice of having various holders for use in the lathe or planer, into which are placed the smaller tools which do the actual cutting There is no doubt that there is a considerable saving by this plan in forging, grinding, and in the amount of steel which is required to fully equip a shop. This again admits of the use of a better grade of steel for the comparatively small cutting tools, in which there is economy without doubt.

For boring and internal thread cutting the device, Fig. 1, is used to good advantage in place of the ordinary tool-post. It is bolted to the top of the tool-rest by the bolt *b*, which engages with the T-slot in which the tool-post stands, and the tools are passed through the hole at the end and clamped in place by the two small screws. The hole is made large enough for the largest tool used, and plain, straight split bushings used for the smaller sizes. The tools of course are plain, straight and round, just as they are cut off the bar, and require no forging except to shape the cutting edge. A tool made and used in this way need never project further than is absolutely necessary for the job in hand, which is a great advantage, not only on account of the increased stiffness, but because a tool of a given size answers for all holes of the corresponding sizes, regardless of their depth. In some cases, bars of ordinary round steel are used in this holder, in the end of which are fastened small cutters which do the boring or thread cutting. For the smallest work a holder made in the same form, except that it is adapted to be held in the tool-post, is used.

TRUING LATHE CENTERS.

For truing lathe centers the tool, Fig. 2, is used. It consists of the holder which is made to be held in the tool-post in the ordinary way, and in this is clamped by the screw the cutter *c*, which is made of the

finest steel, and has its cutting edge ground on a special fixture, to insure its being exactly straight. Set in the lathe by a gauge, it trues up a center very quickly and makes a

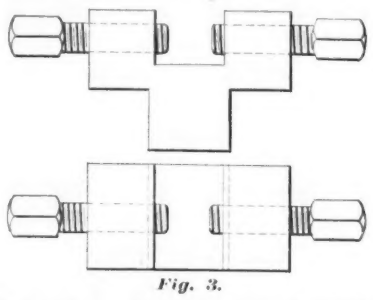


Fig. 3.

good job of it. The same sort of a holder may be made use of for holding cutters for producing any irregular shapes.

Where boring or internal threading tools are held in the tool-post in the ordinary way, and trouble is found on account of their springing away from their work, the device, Fig. 3, is made use of, which simply sets in the T-slot of the rest in such a manner that one of the set-screws comes each side of the projecting end of the tool, and prevents all movement of it. It is found to stiffen a tool very much in many cases.

A SCRAPER.

It is a very rare thing to see in a shop any departure from the time-honored practice in the matter of the making of scrapers for finishing plane surfaces by hand. They use one here, nevertheless, with which they are much pleased, after giving it a pretty thorough trial. It is shown at Fig. 4, and consists simply of two clamps, which are attached to a handle made of light wood in such a manner that, by loosening the bolt, the handle may be made to stand at any convenient angle to the surface of the work. The blade *c* is made in the form shown, being "hollow ground" on each side, and with its edges alike. By grinding away the middle of the edges a little, as shown, a comparatively small surface is left to be oil-stoned. The blades are kept in stock, are made of the finest steel, and cut with remarkable freedom and smoothness.

DRAWING-ROOM SYSTEM.

In connection with the additions to the shop already referred to, a new fire-proof vault has been constructed for the safe-keeping of drawings, and Mr. Charles H. Fogg, who has recently taken charge of the drafting-room, has introduced a system of filing and indexing drawings which seems to possess many very desirable points. It is simple, easily managed with the minimum of work or attention, and is elastic, lending itself readily to any changes or additions which it may seem desirable to make. Mr. Fogg gives the credit of its origin to the Blake Steam Pump Works, where he first saw it in use, and upon proposing its adoption to Mr. Brainard, the general superintendent here, it met with approval.

When a new machine or any important modification of an existing one is being schemed out, it is usual to first make full size drawings on brown paper, the sheet used not being confined to any particular size, but may be of any size required by the work. Such drawings comprise Class "A," and they are so marked. Large drawers in the cabinet, made to hold drawings, are devoted to these drawings, and they are folded to go in them.

Then there are four regular sizes of drawings, made on sheets of "Crane's Bond 25" paper, from which the blue prints are made. The largest size of these sheets is designated by the letter "B," the next smaller "C," and so on down to the smallest, which is "E," each size being just twice as large as the next smaller.

All the drawings are numbered consecutively, as they are made without regard to their size or the subject to which they relate, and are marked with this number immediately after the letter designating the class to which they belong. All four corners of each sheet are thus marked, so that they may be readily seen when placed in the drawers. There are drawers for each size of sheet, and the drawings are put into them without regard to classification, except as to size. Each drawer is then marked on the outside with the letter indicating the size drawings it contains, and also with the lowest and the highest number of drawings in it.

A number of cards are provided, which may be of any convenient size, of course, but in this case are 5″x2″. They are placed in a box 2″ deep and 5″ wide, and are separated into series, according to the letters of the alphabet, by strips of wood of the same size, which are placed between them, each strip having marked upon its upper edge the letter indicating the series to which the cards below it belong. Copies of some of these cards are shown on a reduced scale at Figs. 5, 6, 7 and 8.

All the drawings for a given machine are indexed on a card together, which is headed with the name of that machine, as shown by

48 in. Aut. Gear Cutter.

D-31. Cutter Arbor box.
C-32. Gear covers.
C-34. Details.
C-35. " "
C-66. " "
B-51. Belting diagram.
B-71. Plan (complete).

Fig. 5.

Cutter Arbor.

C-66. 48″ A. G. C.

Fig. 6.

Cutter Spindle.

C-66. 48″ A. G. C.

Fig. 7.

Thomson-Houston Electric Co.

D-67. Cutter No. 3 M. M.

Fig. 8.

Fig. 5, this card showing, for instance, by the first entry on it, that the drawing for the cutter arbor box for that machine is made on a sheet of size "D" and No. 31. The sheet

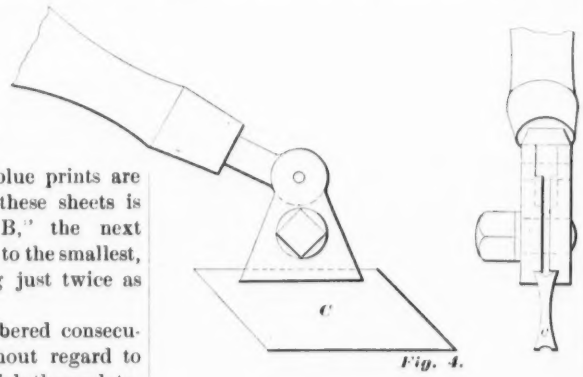


Fig. 4.

can be easily found by reference to the letters and numbers on the outside of the drawers. In addition to this, each sheet is indexed on another card by the name of the piece of which it is the drawing, as shown by the card, Fig. 6, upon which all drawings of cutter arbors, for whatever machine, are indexed together; the first entry on this card showing that drawing for the cutter arbor of the 48″ Automatic Gear Cutter is on a sheet of size "C," numbered 66. All cutter spindles for all machines are indexed in the same way on a card devoted to them, as shown by Fig. 7.

It is sometimes desirable to index drawings by the name of the person or firm for whom the work is done, and in this case such a card as shown by Fig. 8 is made out, which in this instance will be found in the box in series T, and on this card all the drawings for the work done for that firm will be indexed, in addition to the indexing in the regular way by name of machine and name of part, as on the other cards. Though the description of the system to be complete must be perhaps a little tedious and complicated in appearance, the system is simplicity itself, and a very little study will make it plain.

Work for the Railway Master Mechanics Association.

The *National Car and Locomotive Builder*, after pointing out the good work that might be done by the association in investigating further the question of valve motion for locomotives, concludes as follows:

"We consider that a very useful report might be prepared on the best forms, dimensions and proportions of the various parts of the link motion. There are certainly good and bad link motions in use, and it would be of direct service for many railroad men to read an exhaustive report on the causes that produce the difference which is apparent to every man familiar with the working of locomotives. Great improvement has been effected in the designing of link motion since draftsmen abandoned the antique model for laying down the lines and points on the drawing board, but there is still much ignorance to be dispelled about the scheming of link motion. We know of roads where till lately one form of link was used for all locomotives. Engines with long eccentric rods and short eccentric rods, those having valves with long lap and valves with short lap were all supposed to work equally well with a link of uniform length and radius, and the hanger pin set in the same place. On another road we have seen the resources of a machine shop exhausted in trying to square the valves of an engine whose frames had been lengthened and the driving-wheels spread six inches and no change made in the valve gear beyond lengthening the eccentric rods. It was considered to be remarkably strange that the cut-off should be so hard to equalize. This did not happen in a remote period of railroad history either. There is a great deal of uncertainty, where there ought to be exact knowledge, as to the effect of long and short link radius, about the location of the point of suspension, and about other really important questions connected with valve motion mechanism. The committee which will present plain and conclusive information on these matters will earn the gratitude of numerous railroad men."

The Vulcan, the new torpedo depot ship, was laid down at Portsmouth in June, 1888, and was intended to be completed some time next year. She is of 6,620 tons, 12,000 horsepower, and designed for a maximum speed of twenty knots. Her armament is to consist of eight 4.7-inch and twelve three-pounder quick-firing guns. She is also a floating factory for the repair of torpedoes, torpedo boats and their engines. It is impossible to exaggerate her usefulness to a squadron, and it was of extreme importance that she should be got out of hand with the least possible delay. Now I am informed that the mountings and supports of her 4.7-inch guns are considered insufficient, that they are being strengthened, and that this involves the pulling up of decks and the pulling down of cabins at the cost of much time and money. —*London World.*

How to Clean Brasses and Bronzes.

The brass articles that are fashionable just now require careful attention to keep them clean and bright. If not lacquered, rub sweet oil on the flannel, then rub them over with rotten stone, using a second piece of flannel; finally polish with a chamois. If lacquered, wash with a soft brush in warm water and soap, wipe well, and set before the fire until perfectly dry.

Bronzes are cleaned with sweet oil, rubbed on with a brush; then rub off with a second brush and polish with a chamois. Another plan is to plunge them into boiling water until very hot, then wash with flannel and yellow soap, drying carefully with soft rags. If soap and water prove ineffectual, try beeswax, dissolved in turpentine, rubbed on and off with clean, soft rags.—*Unknown.*

New Ferryboats.

The ferryboat "Bergen" has given such satisfaction as to encourage the Hoboken Land and Improvement Company to build two other ferryboats with a propeller at each end. But instead of using a triple expansion engine, two upright compound tandem engines will be used; the reason for the change is that the high pressure cylinder on the triple-expansion engine cannot be brought into action as soon as it is desirable to do so.

A new ferryboat for the New York, Lake Erie & Western R. R. is about completed, and will probably go in service before the end of the month. This boat has also one propeller at each end; they are driven by a compound engine whose high-pressure cylinder is 26 inches diameter; low-pressure cylinder, 50 inches diameter, and stroke of both, 30 inches.

The Pennsylvania R. R. have also commenced a new ferryboat with one propeller at each end. Two compound engines of the tandem type will be used.

Col. Hope, of the British army, is reported as saying: "I consider the Bethlehem gun plant to be superior to any gun plant in the world. Bethlehem is the realization of my dream of what a perfect gun establishment should be, and I believe it to be the only perfect establishment of its kind in the world. The gunshops of this place are prodigious in size, the capabilities of the establishment beyond the conception of any one who has not visited it, and the excellence of the material turned out unequaled in point of thoroughness. This I say without a shadow of exaggeration. I could only look and wonder, and I return to England firmly convinced that in America exists the greatest gun and steel-producing plant in the world."

We had thought that the talented and versatile newspaper reporter had invented about all the possible causes of boiler explosions, but a new one comes from St. John, N. B., where a boiler exploded "with great violence" (as they nearly always do), killing six men and wrecking buildings. The dispatch says:

From what can be learned, the boilers were low, the water was turned on, and the person in charge neglected to turn it off, with the result that the boilers overflowed and exploded.

From this it will be seen that it is very dangerous to allow boilers to overflow.

In the city of Delaware gas costs only seventy-five cents for one thousand feet; but the city owns the gas works and supplies itself with all the light needed for public purposes, and makes a small profit on what is used by other consumers, who are the city's customers. It would pay any city to own and operate its own gas works.—*Jersey City Journal.*

While we talk a great deal about the impoverishing effect of the army appropriations of Germany, it may be instructive to note that this country expends annually a good deal more than Germany in army matters, and that in naval matters the United States is far outstripping Germany in the way of expenditures.

LETTERS FROM PRACTICAL MEN.

Boring and Inside Threading Tool.

Editor American Machinist:

Wishing to cut a lot of square thread nuts, and feeling the need of better facilities than anything in the market, or the usual forged tools, we studied the matter and devised the tools shown in the accompanying figures.

Fig. 1 shows a holder which will be familiar to many. It was made of round machinery steel milled to fit tool-post, and end dovetailed to fit cutters of corresponding shape; holder split and screw put in to clamp cutter.

By the use of the cutters, Figs. 2, 3, 4, and measuring device, Fig. 5, the nuts were bored, faced and threaded without measuring after the first one. Fig. 2 was for boring; being double-ended the round end was used for roughing by running the lathe backward, and finished by square end running lathe as usual. This made a smooth cut, using the same feed as when threading. To set this tool to always bore the same size, Fig. 5 was placed A side against holder, and tool put against set-screw projecting the most.

Graduations on cross-screw were used for sizing, and, by using the other end of Fig. 5 for setting thread tools, the same point on graduations was used for both boring and turning. One set-screw in Fig. 5 projecting as much more than the other as the depth of thread desired. These screws were easily and accurately set with a micrometer.

Fig. 4 was used for facing the front of nut, and, if desired, a similar one could be used, and face the back side also, thus making a perfectly accurate job, and turning them out rapidly and easily.

The common forged boring and threading tools are about the poorest tool used in a machine shop, most always too long or short, too large or small, never being just right; and a tool like this, if on the market, would "fill a long-felt want." "DAVY."

A Word of Caution.

Editor American Machinist:

That portion of your valuable paper relating to shop experience is undoubtedly read with interest and profit by most of your practical subscribers, and as many of us are men who require an occasional admonition in regard to what may happen if sufficient care be not taken during certain operations, I will call attention to the disastrous results which may follow where new and dry metallic surfaces are being fitted together. If a newly turned steel or iron shaft be slightly forced into a newly bored hole in cast or wrought-iron, the chances are that it will have to be driven out with a sledge hammer; many an unpleasant experience has resulted from such careless action. Care should be taken to remove all dust, and the surfaces should be oiled on every portion before any shaft is forced into a hole, no matter how little pressure is required to get it there.

A case which brings to mind unpleasant recollections is that of fitting a face plate to a lathe spindle. The fit was a good one, and not too tight, but no oil had been placed on the cast-iron thread before the plate was screwed home; the result was the plate never came off the way it went on, but had to be cut off with the turning tool, and the thread on that spindle was never a pleasant thing to look at after this occurrence.

Accidents of this nature, from the ignorance or carelessness of workmen, are so common, and the results sometimes so serious, that it might perhaps be well to have printed instructions placed about the shop as an occasional reminder. Societies for the prevention of swearing, please copy.

T. R. ALMOND.

Some Rolling-mill Notes.

Editor American Machinist:

About ten years ago I was asked by the superintendent to take charge of the machinery in a large western rolling-mill. I declined, giving as a reason that I was wholly inexperienced in such machinery—not having at that time even seen a rolling-mill. To this he replied that if I would look after the interests of the company he would risk the mechanical part I had to play. With the understanding that his remarks did not imply any injustice to the men in my employ, I accepted the situation. I have often thought I ought to have demanded that he should look out for my interests with the same zeal that I did the company's; for, although the output of the plant has been largely increased, and the expense of my department lessened, my salary has not been struck by any "giant strides" that would make things harmonious.

Besides the machinery for the manufacture of "merchant bar-iron," there is machinery for making nails, spikes, links, pins, etc.; three blast furnaces and four locomotives, three narrow and one standard gauge; about one hundred boilers and fifty engines, varying in size from 5"x10" cylinders to 36"x60"; there are no two of the engines alike, and only two instances where the same maker furnished two engines. But little system had been exercised in any mechanical department of the plant. Until about the time I went there, no draftsman had been employed, and the one employed then did not stay long; being offered a better situation, he went West, and has since risen to the superintendency of an extensive works.

About the first thing I did after taking charge, was to make a record of every piece of machinery brought to the shop for repairs, as well as the repairs made in the mill, and when a broken or worn-out piece was to be replaced, the haphazard or happen-so sizes were standardized, if possible, so the parts could be more readily duplicated. The general strengthening of the weak places in the mill machinery was closely looked after. The use of iron or steel for various purposes was given due attention.

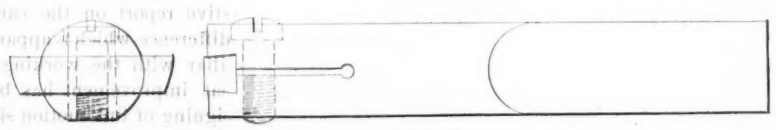


Fig. 1.

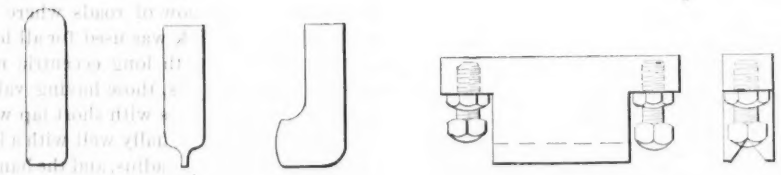


Fig. 2. *Fig. 3.* *Fig. 4.* *Fig. 5.*

BORING AND INSIDE THREADING TOOL.

With the first issues of the AMERICAN MACHINIST for 1887, there appeared numerous replies from master mechanics giving their experience and opinions as to the best of the two (iron or steel) for crank-pins and other parts of locomotives.

These all bore directly on the subject, but did not settle the question by any means, so I concluded to run an excursion into the field of experiment, and determine, so far as possible, which was best for mill machinery. (All it costs to take this trip is the time it takes to read it.)

In your issue of Oct. 2, page 5, you give a cut of a shear which will serve to illustrate some points I wish to call attention to. We have about twenty lever shears practically the same as this one, from very small to very large, the largest cutting such sections as five inches square or round, old locomotive frames, etc.; these shears are used only for cutting scrap, new iron of such large round or square section is sawed either hot or cold. Now, of any one piece, shear "pins" did break most frequently. The "pin" is the shaft which passes through the shear bed and shear lever just back of the knives, as shown in the engraving referred to. I make these "pins" a driving fit in the lever, and let it work in brass boxes in the bed. In our bar mill shear, the pin was five inches diameter its whole length, and always broke about three or four inches inside the lever; just why they should break there I have never been able to figure out to my satisfaction. I thought this a splendid chance to give steel a trial, and did so. I ordered a half dozen steel pins, and put them in. They broke in the same place, and about as often as iron ones did. Thinking that the holes in the levers were bad, I had two of them bored out to five and an eighth inches, and in one I put steel, and in the other iron, and knew that both were good tight fits. They were both in about a year, and both broke inside the lever as of old. The steel one did a great deal the most work. A broken pin is discovered by an unusual spring when cutting. Some old narrow gauge locomotive axles made the most sensible pins we have ever had. As opportunity permits, I bore out the levers to $5\frac{1}{2}$", and reduce the journals on the pins to $5\frac{1}{4}$", and broken pins are things of the past. I have not tried steel pins since boring out the levers.

I conclude from this and many other uses I have put steel to, that it is an unknown quantity, while good iron may be made to a certainty and depended on; so in places where neither is good enough I will risk iron.

One of these shears gave me about as big a surprise as I ever had; it was a new one, and was started while the superintendent was showing me the plant for the first time. The tail end of the lever rides on a cam, which revolves under it, thus giving motion to the lever. The cam was not turned, neither was the lever planed; both just as they came from the foundry, and not half cleaned, as I had been used to seeing castings cleaned. The shearman daubed some grease on the cam with a swab and started up. I applied my rule of one thousand pounds to the square inch on sliding surfaces, and informed the superintendent that the tail of that shear lever would be ground out in about twenty-four hours, but it has been running nearly that many hours a day since, and not worn down half an inch. It is an improvement, however, to chill the "coming" side of the cam, and that part of the lever that wears on it. This reduces the friction very materially.

C. O. S.

Critical Notes—About Pumps.

Editor American Machinist:

It is a notable fact that every improvement which is made, or new invention that is developed, is sure to displace other things, which, although not so good as the new, are yet possessed of advantages that would be valuable if they could in some way be combined with the new without retaining the faults of the old.

From an early period the steam boiler was supplied with a pump actuated from the main engine, and although this was an economical way in most cases, it had the important disadvantages that the boiler could not be fed without running the engine, and there was no good means of regulating the quantity of water supplied by the pump.

The next improvement was the using of a separate engine of small size for the special purpose of feeding the boiler, after which came the direct-acting steam pump, which in various styles is used everywhere. The chief reason for the rapid adoption of the direct-acting pump was that it was an independent affair, and its speed could be regulated to supply just the quantity of water needed, while the first cost of it was less than the old style. Up to the present time these qualities seem to have been enough to overbalance every other consideration in the minds of most steam users, but the fact is that, regarded as a machine to perform economically a certain duty, it is not so good as the one it displaced. A serious objection to the single cylinder direct-acting pump is that the ordinary engineer cannot understand the construction of the steam valve operating mechanism, and if anything gets wrong with it an expert must be sent for. Not long since, I saw a case of that kind. The pump got on a strike, and after the engineer had labored with it about two hours without visible effect, the pump doctor from the shop that made it was sent for. He came and dissected the steam chest. While it was apart I noticed a plate with various holes and ports through it, the like of which I had never seen before; the nearest resemblance to it I have ever seen was a plank full of worm-holes, and if you were to drop a pea in one of the holes there would be no certainty which side it would come out of. I think the average engineer could not understand how it operated without a hard day's study with the assistance of working diagrams.

I once went with an engineer who was to select a steam pump, and after he had looked at it a few minutes he took out his watch, and, while he noted the time, he throttled the steam supply until the pump made about two strokes per minute. After it had crept along that way about 15 minutes, he decided it was a good pump, and said he would take one. I suppose he wanted to see how much steam it was possible to condense with it in a minute.

In the last few years there have come into use what are called independent condensers and air pumps, the pump part of it being simply a direct-acting steam pump. There may be cases where it would be best to use such an arrangement, but if it is considered profitable to use a condenser with an engine I believe it isbad policy to lose one-fourth the possible saving from the use of a condenser by using a direct-acting steam air pump. One of the prominent advantages of the independent condensing apparatus is that it may be used to get a vacuum in the condenser to assist in starting the engine, and when this is necessary of course nothing else can take its place, for it is then a question of expediency, not of economy.

A common plan of driving the air pump by the engine is from the crosshead, but this has two objections. First, the connection to crosshead causes a side strain on the guides, and an extra duty on the crosshead; and second, the air pump must make the same number of strokes per minute as the engine, and in most cases this is too fast a piston speed for the pump to work well. In fact, I have known air pumps driven in this way to be abandoned on that account, and an independent pump put in their places.

Another plan is to have a geared pump driven by a belt from the engine, and this is probably the most economical plan in use, and certainly the mechanism easiest taken care of.

The objection to all sorts of engine-driven pumps is that the speed cannot be varied to suit the duty thrown on them, but I think it would be possible to design some arrangement for varying the speed without very objectionable complication. With this improvement the engine-driven pump could hold its own against all others on the score of economy, durability and facility for repairs.

About all the bad features of the engine-driven air pump are also found with the boiler-feed pump driven in the same way, except that it may be run at a uniform speed and the feed water to the boiler regulated with a by-pass valve, which allows part of the water to return to the suction side of the pump. But that is objectionable, because the water so returned represents lost work, and it would be better to regulate the supply by controlling the speed of the pump.

Some saving is effected in the steam feed pump by using a fly-wheel, and cutting off steam at three-quarter stroke, but a builder of steam pumps says it costs more to build a fly-wheel pump, if the wheel is of sufficient weight to be effective, and they cannot be sold in competition with the direct-acting pump. I argued that the saving of steam ought to be enough to more than pay the interest on the extra cost, but he still stuck to his assertion that they could not be sold.

A friend of large experience in such matters said to me, regarding the commercial aspect of an invention: "If you invent something better than others in the market, which you can sell at the same price, you may by perseverance be able to introduce it, but if you invent something just as good as others, and can sell it considerably cheaper, success is assured at once." I suppose this is largely true of the steam pump business, and as long as direct acting pumps can be sold cheaper than others they will be used more than other kinds, even where it is possible to use an engine-driven pump; but where economy is the object, and money to purchase is available, it is certainly very bad engineering to use a common direct-acting steam feed pump for continuous boiler feeding, or air pump on condenser, with a modern economical steam power plant. BELL CRANK.

An Improved Taper Gauge.

Editor American Machinist:

After reading an article by "A Mechanic," in your paper dated October 16, 1890, on improved or extension micrometers, it encouraged me to write this article. I have here the drawings of a very useful tool, which, like "A Mechanic's," cannot be found in the market. This is an improved taper gauge. Many tool makers and machinists appreciate the value of a good gauge. Figs. 1, 2 and 3 show the improved, while that shown by Figs. 4 and 5 is a style quite old. As is easily seen, the latter is confined to one class of tapers.

It is impossible to set it to *A*, Fig. 2, and a similar difficulty is clearly seen in Fig. 3. It can only be used on the end of a piece of work such as lathe centers, etc. It is obvious the improved gauge will take a taper anywhere, not being confined to work in particular places. It will take all that the old style will, besides such pieces as the drawings show. The drawings look so plain it is needless to explain all the parts of the improved tool. At Fig. 2, *B* is the V-block, with holes drilled in it, to shift for convenience sake; *c* is the blade which is to be over the center of the V-block. The drawings show knurled thumb-nuts, but I believe the winged nut would prove better. A gauge about four times the size of the drawing would make a good size for practical purposes. This tool is not patented.

ANOTHER MECHANIC.

Economy of High Pressure Steam.

Editor American Machinist:

In your editorial (Nov. 27) on compound locomotives, in reference to a former letter of mine, asking for the data about the economy of using high steam in single expansion locomotives, you say in effect that it is only where the conditions are not favorable that economy does not result. After many quotations of what ought to be done, you wind up by saying that it all proves nothing—an honest confession.

It was not my intention to enter into any discussion of this matter; I only wanted some facts which it was expected you had at your fingers' end, but that it had not been my luck to have. If you had furnished such it would have been entirely satisfactory. As you have not, I am yet on the anxious seat, still seeking for something I have not found.

When you speak of the "link gears," it leads one to think where there is not any economy in using high steam it is the fault of the design of the link. It does not appear to me that any very great difference in the link motions used on locomotives in this country is found. I do not see any great improvement in this "motion" for the past thirty-five or forty years. I have in my mind some engines built by Rogers, Ketchum & Grosvenor, in 1852, which had the link with all of its purity, and equal to anything I have seen since. These engines were placed on the road by Mr. Lewis (now M. M. of the D., L. & W. R. R., at Kingsland, N. J.), and I think he will corroborate the above statement.

You think that the exhaust will be at less pressure when using high steam. If so, I am wrong again. A certain railroad was doing its work with an engine 17x24, wheel, 5 feet 6 inches; weight, 70,000 pounds; carrying 130 pounds steam. When the work outgrew this engine another was built 18x24—same size wheel and same steam, which answered for some time until more work was required. The next move was an engine with 17x24 cylinder—wheel same as former engine, weighing 100,000 pounds, and carrying 170 pounds steam, which is now doing the work. Am I to understand that it is possible to get the work out of such an engine when the cut-off is so short that the exhaust is at a lower pressure than by engines of larger cylinder and lower steam? And, if so, why this additional weight? I do not know of a single case where the cylinder has not been reduced materially when the same work was to be done with the high steam that was formerly done with steam of lower pressure. These assertions require no proof when you look at the locomotives now being built for high steam. About 75,000 or 80,000 pounds was the standard for a ten-wheel engine with cylinders 18x24, steam 130 pounds. Now we find them with that size cylinder weighing 110,000 to 125,000 pounds, where they are to carry 170 pounds steam. Why so much weight if they are to do only work that will allow them to cut off so short that the exhaust will be of lower pressure than the former engines? If this amount of adhesion is required they must use steam about as far each stroke as other engines of the same pressure, and if so I think that the steam will leave the exhaust somewhat hotter than it would if only 130 pounds were carried. Am I right?

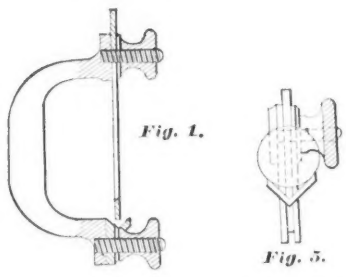
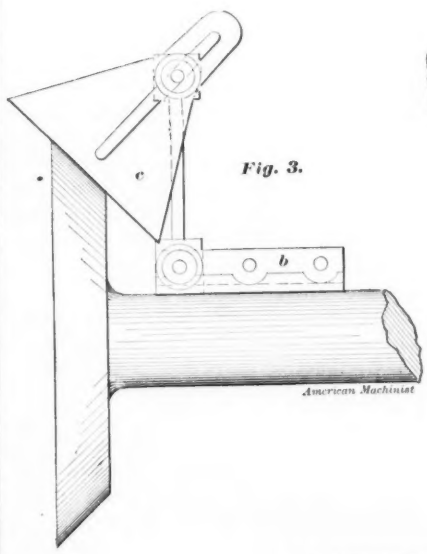


Fig. 1.

Fig. 5.



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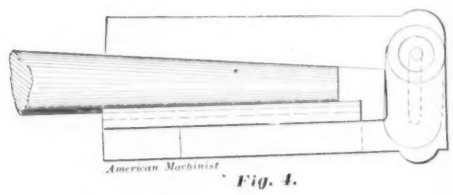

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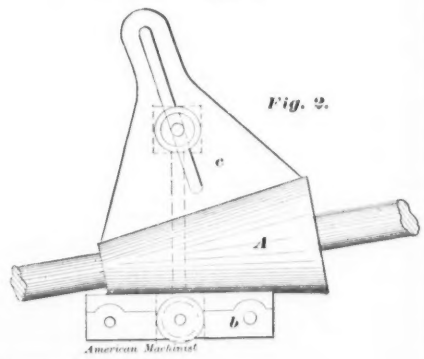

Fig. 2.

AN IMPROVED TAPER GAUGE.

If wrong, why are all the engines to carry high steam so much heavier for same work? It is not any use to go into details as to why there is not any economy in cutting off less than one-third stroke with the link motion, when you, as well as any one, are aware of the early release and compression that occurs when steam follows less than one-third stroke, when the link is used for a cut-off. When indicator cards show so little space between the steam and compression lines it requires little study to determine that the engine is doing very little work.

When you assert that economy of high steam in the locomotive can be obtained in two ways, one by cutting off earlier (which is not the practice), and the other by throttling, this appears the "most unkind cut of all." Are we to understand that carrying 180 pounds on boiler and using only 130 pounds in cylinders is economy? If such is the case, why do not the Sound steamers have boilers to carry 180 pounds, and throttle down to 35 pounds, and thus economize? Why don't the throttling governor on stationary engines show economy the same as automatic cut-off engines? Where is the person who dares to say such a thing? What the engineer wished, was, if there was any economy in using high steam, as is being done on locomotives in this country, to have the facts and figures, as it has been an honest doubt in his mind (when all things were considered) if it would make a good showing. Now, if you can give some facts about what is being done (not what ought to be done), it would be very much appreciated by more than one engineer, as well as by many who are paying the bills for using high steam in single expansion engines of any kind. Hoping you can furnish such, I will wait patiently.

ENGINEER.

[As we have, in effect, stated previously, there is, so far as we know, no reliable data as to the economy—or the contrary—of high-pressure steam in locomotive practice. There is nothing upon which to base an opinion, except theory and the practice of master mechanics in the way of increasing pressures. Applying such reasoning to the case cited by "Engineer," a 17"x24" did the work with 170 pounds steam pressure that the 18"x24" failed to do with 130 pounds. That is the way we understand it. Now, while we do not believe for a minute that one-third stroke is the most economical point of cut-off for a locomotive engine with 170 pounds steam pressure—even if it is with 130 pounds—let it go at one-third in both instances, and what do figures show? We have no indicator diagrams to work from, so we must give one engine the same advantages or disadvantages of figures as the other. Doing this, we find that (at one-third cut-off) the 17"x24", with steam pressure 170 pounds, will do about 18 per cent. more work than the 18"x24", with steam at 130 pounds—a very good reason why the higher pressure "is now doing the work."

Applying figures a little further, the 17"x24" will use about 14 per cent. more steam than the 18"x24". That is, 14 per cent. more steam to do 18 per cent. more work. Here, then, so far as figures can be made to show, higher steam has brought about the economy resulting from ability to do the work required, and, at the same time, a saving of fuel—a small saving—has been effected. It is possible a still greater saving would have resulted from using the high pressure in the large cylinder, increasing the weight of the engine, and cutting off shorter than one-third stroke.

As to economy of throttling when conditions are against further expansion, we have demonstrated this to our own satisfaction in the instance of stationary engines, steam pumps and the like, and do not see why it should not follow in the instance of a locomotive. And we find that intelligent locomotive engineers believe it does follow.

We believe it is the intention of master mechanics to get more work from a certain sized cylinder when the steam pressure is increased. But if in the main it was only intended to increase economy by an earlier cut-off, increasing the weight would prevent slipping at starting, and provide greater power in an emergency.

It is useless to discuss the question of why a throttling engine is not as economical as an automatic engine. "Engineer" understands this as well as any one. But throttling damp steam to a certain extent may be advantageous, notwithstanding.]

Sketches of an Apprenticeship.

BY W. S. ROGERS.

XII.

The foreman in our shop was one of the best men for the place I ever met. He was a genuine engineer. No matter how much too crooked or too big for our tools the job was that came into the shop, he never refused it, and always found some way of getting it done.

Although he was quiet and taciturn in his ways, and spoke his mind to us cubs pretty impressively sometimes, he never did any cussing round the men; and he would get real sociable when trying to get a kink in our dull heads. In fact, it always seemed that one big boy was teaching us smaller ones until we caught his ideas, then he would freeze back into a cold-blooded hustling foreman again.

On one occasion there was a pulley 18 feet in diameter and 25 inches face brought to our shop. It was to be turned, crowned and bored, and every one about the place thought that Tom had overreached himself, as our largest lathe was only 48-inch swing, and the boring mill would only take in five feet. Tom didn't do much for some time but gaze around the shop in an abstracted way, and we knew he was dreaming pretty hard over that pulley. Finally he began giving orders, and we knew he saw his way out. First, he spliced the main line shaft so that it stuck out through the end of the shop into the yard, then the 24 inch drill was moved out, the big pulley dropped down over it, squared up and leveled, a boring bar put in the drill spindle, a belt put on from the line shaft pulley, and one of us cubs bored that pulley like cheese. While the boring was going on the laborers were digging a pit close to the wall, and the carpenter put down a frame; a shaft or mandrel was being made, and boxes babbitted to it, and some old gears and pinions fished out of the scrap pile and storehouse. Then the pulley was put on the shaft, and dropped down in the pit on the frames, and the bearings. The gears were put in reduction form, and again the belt went on, and that pulley began to rotate, making a complete turn every three minutes. Then the cross-rail of the 30-inch planer came out, and was bolted on the timbers. A ⅝-inch hole, drilled eccentric in the end of the shaft, carrying a stud which operated the rod connected to the feed on the cross-rail did the rest, and as we cubs watched the turning and crowning of that pulley, we decided unanimously that, if ever it was our luck to stand in Tom's shoes, the job would never come along that we would refuse to do because it was too large to come in the shop door.

Tom told me afterwards that he lay awake several nights thinking that kink out, and he felt ashamed afterward when he saw how simple and easy it was.

The Providence (R. I.) *Evening Telegram*, of recent date, has an account of the performance of a machine for handling lumber and unloading it from vessel to dock. It is the invention of Mr. Volney W. Mason, of that city, head of the firm of Volney W. Mason & Co., and, to judge from the description, is a very successful machine, though not much that is intelligible can be gathered regarding its construction and operation, except that it is driven by electricity, and, by a combination of derricks and carriers, takes the lumber from the hold of a vessel, and deposits it in any desired part of the yard.

Mr. C. J. H. Woodbury writes us: "In looking at the article, 'One-story Machine Shop,' in your issue of November 27, I see a mistake which is entirely my fault. The sentence beginning, 'The sills are made of 6"x6" upright studding' should begin: 'The studs are made of 6"x6" upright studding.'"

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NEW YORK, DECEMBER 11, 1890.

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As Others See Us.

Our American metallurgists and iron and steel makers seem to have little cause for feeling flattered by the opinions of the members of the British Iron and Steel Institute, as expressed to some of those who accompanied them on their visit of inspection in this country. It is an open secret that they found much to criticise here, and, as this criticism was not confined to generalities, but specific things and practices were mentioned as being capable of improvement, it will, it seems to us, be worth the while of our American producers to give careful attention to them.

The editor of the *Engineering and Mining Journal*, who enjoyed uncommon opportunities for getting the real consensus of opinion of our visitors, gives in his journal the particular points of American practice most criticised, and says, "While much of the criticism was undoubtedly due to the mental habit of the Englishman—he is usually on the lookout for something to find fault with; but it is well for us to be criticised occasionally, as it may reveal to us shortcomings which we had not before suspected, and lead to improvements in our practices, even if it should necessitate the copying of some foreign ideas and methods."

With the spirit of this we are entirely in accord. We believe, and we think it is readily conceded by most of our late visitors, that American engineers and metallurgists have done great things with the means at their disposal, and in many respects are, to say the least of it, not behind any other nation. But it is the height of folly for a nation, as well as for an individual, to wrap itself in its own conceit and assume entire perfection.

The gist of the criticism of our foreign guests seemed to be that the larger amount of products from our blast furnaces and rolling-mills was obtained by a rate of driving for machinery and men which would not be tolerated in England—a rate which rapidly destroyed the furnaces and machinery, and which British workmen would not stand.

The waste of material and fuel was generally thought to be excessive, and much greater than in England, while the engines and boilers used were not generally so good, or durable. The new shops of the Westinghouse Machine Co. at Wilmerding, which are generally regarded as representative of our highest attainment in the line of "shopitecture," were criticised as being insufficiently lighted.

Of course it is to be remembered that much of this criticism is to be attributed to a failure to take into account and give full weight to the different conditions found here, as is the case undoubtedly with English criticism of our locomotives.

Taking the matter of light in shops for instance. It is the practice on the other side to build machine shops only one story high, and put on what are called "saw-tooth" roofs, by which is meant roofs, a cross-section of which resembles the teeth of a saw in shape. In the more steeply inclined sides of these saw teeth is placed the glass through which the principal part of the light comes, this always facing the north, so that direct sunlight does not enter. In our illustration of an English shop—that of Geo. Richards & Co. at Broadheath—such a roof is shown, and there is little doubt that shops having this kind of roof are better lighted than they usually can be from the sides, and that an Englishman accustomed to such shops would consider ours rather dark. But just here is where a difference in conditions comes in, the difference in this case being one of climate.

Over a large part of this country it is considered that during the winter months, which are the ones when light is most needed, these saw teeth would be filled with snow, which, protected from the sun, would be difficult to get rid of; the milder winter of England causing no trouble on this score.

Professor Sweet, who has had considerable opportunity for studying foreign shop practice, has so much belief in the advantages of this form of roof, that when he came to design the new shops of the Straight Line Engine Co., at Syracuse, he adopted it as shown by illustration of these shops in issue of Sept. 4. Syracuse is a good locality to test the adaptation of the roof to American climate, and the result of the test will be watched during the coming winter months with considerable interest, and that form of roof adopted without doubt, in many cases, if it proves successful. And if it does prove successful then the criticism that our shops are not well lighted will have force, and should be heeded, while, if it does not prove successful, it would seem that our latest shops are about as well lighted as circumstances permit.

We have thus examined one criticism—the one in which our readers are most directly interested. The others made by our visitors should all be carefully examined by those most directly interested in the matters criticised; not with a view to justifying or showing the superiority of American practice, but with the sole object of ascertaining the truth about ourselves. And wherever we are found to be behind our trans-Atlantic friends, let the reasons be sought for. If these reasons be found to be sound, well and good, but if not, then improvement should be made, entirely without prejudice as to the adoption of foreign ideas.

Criticism is far better than flattery for those who are wise enough to make proper use of it.

Engineering Papers.

Last week we referred briefly to the cutting off of the topical discussions, at the meetings of the mechanical engineers, as a misfortune. There is, besides this, and in the same line, another subject that may be mentioned—that is, the character of the papers presented at the semi-yearly meetings.

It may be assumed, without argument, that the great mass of the members of the society are men who earned their right to membership by virtue of their knowledge of the mechanic arts; by their ability to plan and construct machines and machinery, and to superintend its planning and construction. In other words, while they are noted for their knowledge, that knowledge has, in most instances, been gained outside of colleges or similar institutions.

While we do not state this as a positive fact, we yet believe that in Europe a much larger proportion of the membership of technical societies is composed of men who have been more specially educated—as the term educated is used—for their profession, than is the case in this country. But in Europe, we think observation will show that the constant tendency during the past ten years has been toward the presentation of papers of a practical character at society meetings—papers couched in language that the average reader, who has forgotten about all of mathematics he ever knew except that which is embraced in the rules of arithmetic, can comprehend without much brushing up of things covered with mental dust. Here the case seems to be quite different; at least, that appears to be the fact in the mechanical engineers' society, to which we are especially referring. Year by year the practical papers appear to grow less in number, being supplanted by—no doubt—very excellent papers prepared by those who use terms beyond the comprehension of a majority of the members, or at least beyond their comprehension without more study than they will ever give them. There are very few things—exceedingly few—in mechanics or engineering that cannot be expressed or explained in simple language, and it does not enhance the importance of any one to express or explain them differently. The Society of Mechanical Engineers is not a technical school whose members must think according to set rules. It is a society composed of men who are too busy to learn new ways of thinking, and who think more of fact than of hypothesis. A man may brush up his mathematics to enable him to wade through the works of such a writer as Rankine, because he is assured in the beginning that he will obtain satisfactory results. But even then he would willingly pay his share of the expense of simplifying the language. All writers are not Rankines, and the writer who makes mathematical strides that his readers cannot easily cover, is not likely to have his work comprehended, or even read, except by a select few. Busy men object to digging too much for unknown prizes that might quite as well be on the surface.

But there is another way to look at this matter. The society meets principally for the presentation and discussion of papers, and if those of a practical nature are not presented, then others must be substituted. The remedy is for more members to present papers written so they can be discussed by the members. Generally this would brighten up the proceedings wonderfully, and stop some grumbling.

A young naval officer, Lieut. W. F. Fullam, recently presented a paper at a meeting of the Naval Institute, in which he sharply criticised some of the things to be found in the management of naval affairs.

The paper provoked much discussion, but most of the older officers who discussed the matter confined, or attempted to confine their attention mainly to the writer of the paper instead of to the paper itself, and seemed disposed to deny his right to criticise.

It is nearly always a bad sign when the friends of an institution object to honest criticism of it. Within the past few years, the weapons and machinery by which naval operations must be conducted have greatly changed, and it would seem to be plain that many of the traditional customs of the service are unsuited to the present age. There is considerably more of the spirit of aristocracy than there should be—the kind of aristocracy which, while it tolerates a mechanic or engineer, looks upon him only as a disagreeable necessity, and keeps him down and back as much as possible.

With the growing importance of the mechanic and engineer in naval affairs, this spirit of aristocracy is in conflict to some extent, and it is probable that some considerable discussion will take place before matters are finally adjusted.

The aristocratic notion which sets some men on a pedestal, and makes them not only better than others, but above criticism, is not at home in this country.

Literary Notes.

The Engineer's Sketch-book of Mechanical Movements, Devices, Appliances, Contrivances, and Details employed in the Design and Construction of Machinery for every Purpose. Classified and Arranged for Reference for the Use of Engineers, Mechanical Draftsmen, Managers, Mechanics, Inventors, Patent Agents, and all engaged in the Mechanical Arts. With nearly two thousand Illustrations, Descriptive Notes and Memoranda. By Walter Barber, Engineer. Second Edition.

This book simply contains sketches of mechanical movements and contrivances, with a short description of each. The aim of the author is simply to furnish the draftsman or designer with ideas in scheming and devising plans and methods for accomplishing desired results in the mechanical arts. Rules for proportioning details of machinery are not given.

The book will undoubtedly be of service in searching for mechanical contrivances or movements to effect a particular purpose, and to some extent will enable the designer to give some originality to his productions instead of marks of his particular experience and training. It will also save time and labor which must otherwise be spent in wading through numerous volumes to find some particular idea.

The book is published by E & F. N. Spon, 12 Cortlandt street, New York. Price, $3.

The New York *Times* publishes a formidable list of British war vessels that could pass through the Canadian canals, while no more than one of our recently constructed vessels could pass through. A little judicious and timely use of some of the high explosives might, and very likely would, fix these canals so that there would be no passing—in the case of war. And then again there is hardly a remote possibility of war between

this country and Britain. Still, such facts as the *Times* puts forth are pertinent, and deserve consideration.

Two organizations of manufacturers of machinery have been, or are about to be formed, in which the farmers of the country will probably be considerably interested.

The one is an organization of the manufacturers of harvesting machinery, the other of manufacturers of threshing machines.

About all the prominent manufacturers are interested in the respective organizations, and it seems likely that power will be acquired to control prices to a great extent, whether the power is exercised or not. But, as is usually the case with the later organizations of that character, pains are taken to state that prices will not be advanced, but that the organizations will be used simply to effect economies in the production and sale of machines, which all are to reap the benefit of. It may be that this will be the effect, but human nature is such that, when a body of men acquire the power to do a thing beneficial to themselves, they are very apt to do it without considering very much the interests of others. All such organizations have come to be looked upon with suspicion by the people, and the farmers, who are just now especially active in looking after their own interests, in the belief that they have been neglected too long, will be very apt to keep an eye on these two organizations. It is a fact, however, that, for a few years past, competition has reduced prices on these lines of machinery to such an extent that the large fortunes made in former years have not been augmented very rapidly.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(458) J. R. H., Enterprise, Kan., writes: Please explain the terms 2 pitch, 4 pitch, etc. *A.*—A gear that is 2 pitch has 2 teeth for each inch in diameter at the pitch line One that is 4 pitch has 4 teeth for each inch in diameter.

(459) F. B., Brooklyn, asks the ever-recurring question as to the proper side of a leather belt to run next the pulley, and again we answer that belts are made to run with the smooth side next the pulley, and that, in our opinion, that is the proper way to run them.

(460) R. S., Rochester, N. Y., asks: Which is the most economical in steam heating—a boiler pressure of 8 pounds, or a pressure of 25 pounds? *A.*—The higher pressure is most economical, although, for ordinary purposes, the lower pressure is preferred; it is safer.

(461) M. M. M., New York, asks: Where can I procure machines for printing gold letters on lead pencils? Also what is the process of such printing? *A.*—The process is one which manufacturers of lead pencils keep to themselves, and do not care to make it public. If any of our readers build machines of this kind, we shall be pleased to hear from them.

(462) E. T. W., Cambridgeport, Mass., writes: I have a machine running at 2,200 revolutions per minute; it takes one horse-power to drive it. What should be dimensions of the cylinder for an engine to drive this machine, speed of engine, and weight of fly-wheel? *A.*—Cylinder, $2\frac{1}{8}$ inch diameter, 3 inches stroke, 450 revolutions per minute; weight of fly-wheel, 50 pounds.

(463) I. H. D. ——, asks: Is there any known method of preventing the warping of shear blades, and similar articles of steel, during the process known as hardening? If not, would such a process have any marketable value? *A.*—So far as we know, there is no method of preventing this entirely, though springing is much reduced by experienced and careful workmen. We cannot say whether the process would be likely to have any commercial value without knowing just what it consists in.

(464) F. W. R., Brooklyn, N. Y., writes: I have an engine which I wish to place in a boat 18 feet long; cylinder, $3x2\frac{1}{2}$ inches; shaft, $\frac{1}{4}$ inch diameter. Please inform me what size wheel I should use. I have a wheel 14 inches diameter, but I think that the shaft is not strong enough. *A.*—For so small a shaft we should use a propeller 10 inches diameter and 18 inches pitch. But if you can make the shaft one inch diameter, a propeller 12 inches diameter and 21 inches pitch will be more suitable for an 18-feet boat.

(465) E. S., ——, writes: I have observed in making steel bushings for jigs that in the process of hardening the hole is made smaller. Is the same result produced in cast-iron? That is, in heating for a shrink fit, will the hole be made smaller? *A.*—Different brands of cast-iron differ in this respect, and it also depends somewhat upon the manner of heating. But in making shrink fits not enough allowance should be made to make it necessary to heat the cast-iron red hot, and any heat below this we do not think has much effect upon size that need be taken account of in practice.

(466) W. T., ——, writes: Please state the power of a boiler 16 feet long, 50 inches diameter, with two 16-inch flues. *A.*—We should rate the boiler at 25 horse-power. 2. How many such boilers will be required to run an engine whose cylinder is 24 inches diameter; 6 feet stroke; number of revolutions, 35 per minute, cutting off at $\frac{3}{4}$ stroke; boiler pressure, 85 pounds; without a load? *A.*—Probably one boiler will run the engine without a load. 3. How much power will be expended in the load? *A.*—With a fair load we should rate the engine at 250 horse-power, and under these conditions it will require 10 of the above boilers to run it.

(467) F. R. C., Ware, Mass, writes: I have had an argument with a friend about a matter on which I would like your opinion. He says that a bar of iron, say 3 feet long and 3 inches diameter, round, will sustain more weight without bending if there is a hole of a certain size through it lengthwise than it would if solid and of the same outside dimensions. He says this is a fact well known among mechanics. I would like to know if it is so. Of course I understand that of two bars of the same length and weight, one having a hole through, the hollow one is stronger, but cannot see how a hollow one of the same outside diameter as the solid one can be as strong. *A.*—You are entirely right about it, and your friend is wrong, the prevalence of the contrary belief among mechanics to the contrary notwithstanding.

(468) X. Y., Schenectady, N. Y., writes: Will you kindly tell me where I may find data relating to the development of the proper curve for end bearings, such as a mill spindle (used in flour mills)? Am I right in the supposition that the curve is known as the Schiele's curve? There is a grain elevator near by, in which a spindle has been run with a bearing that has been quite inadequate for its work, and I want to help our good neighbors out of their difficulty as quickly as possible. The shaft, with its pulleys, couplings, etc., weighs not far from 3,000 pounds, and runs about 80 per minute. It has no other supporting or thrust bearing except the spindle and step at lower end, which is about $1\frac{3}{4}$ inches diameter. *A.*—You are correct in your supposition. The method of laying out a Schiele curve and suitable bearing has been given in our issue of January 30, page 4, current volume.

(469) W. P., Augusta, Ga., writes: I have control of an engine which works badly, and in my opinion the engine is not correctly constructed. The cylinder is 16 inches diameter, 24 inches stroke; number of revolutions, 80 per minute. There are steam, and exhaust ports at each end; the steam port is 1 inch wide and 12 inches long; exhaust ports, 2x12 inches; width of bridge, 1 inch; lap, $\frac{1}{2}$ inch; lead, $\frac{1}{16}$ inch; travel of valve, $2\frac{7}{8}$ inches. At the end of the travel of the valve the exhaust port is closed to $\frac{5}{8}$ inch in width. Are these proportions correct? *A.*—We do not see how it is possible to close the width of the exhaust port to $\frac{5}{8}$ inch, unless the valve has an immense amount of inside lap. If the dimensions which you have given us are correct, we should say that whoever designed the valve made a mistake, and made the edges of the cavity in line with the edges of the exhaust ports instead of making them in line with the inside edges of the steam ports when the valves occupy a central position. Make a new valve with not more than $\frac{1}{16}$ or $\frac{1}{8}$ inch inside lap, and your engine will work much better.

(470) E. F. J., New York, writes: Please inform me what will be the horse-power of an upright boiler 5 feet 11 inches high, and 2 feet 8 inches diameter; sixty tubes $1\frac{1}{4}$ inch diameter; steam pressure 10 pounds; natural draught. How much coal and water will be used in a day of fourteen hours? And how large a house can be heated with such a boiler? *A.*—You do not give the length of tubes or size of fire-box, but from the dimensions given we should estimate the boiler at seven to eight horse-power, allowing fifteen square feet of heating surface per horse-power. The boiler is capable of burning about 400 pounds of coal in fourteen hours, and evaporate about 2,800 pounds, or 336 gallons of water in the same time. The size of the house which the boiler can heat will depend on the construction of the building; a well-constructed building will not require as large a boiler as a cheap and poorly put up one. The number of windows, the kind of plaster, and whether the house is exposed or sheltered are also items which must be taken into account in determining the size of boiler. See answer to Question 297, in our issue of July 25, 1889.

(471) E. H. P., Newark, N. J., asks: Will you please give me a simple rule for selecting the proper gear for cutting a certain thread on both simple and compound geared lathes. *A.*—We have already published such a rule in this volume, and it will be found in the answer to Question 123, issue of March 27. 2. I have a 26″ swing lathe to put up. The cone has five steps, the largest step being about 14″ and the smallest 4″ in diameter. How fast should my countershaft run? *A.*—You have neglected to state the proportions of the back gears, which we should know in order to answer the question intelligently. The speed also depends somewhat upon the kind of work to be done on the lathe. But, assuming that it is to be used for general work, we should speed it so that a piece of work 24″ diameter would run at a speed of 20 feet per minute when the lathe is at its slowest speed. Assuming that the cones on the counter and the lathe spindle are the same size, and that the back gears are proportioned eight to one, this would give for the speed of the countershaft about seventy-three revolutions per minute. 3. In calculating the heating surface, etc., of pipe boiler, will the same rules apply as are used for a shell boiler? *A.*—Yes.

(472) Inquirer, Ft. Wayne, Ind., writes: Railroad engineers say that the minimum curvature on a certain road is 30 degrees, and mention no radius. In the same way builders of locomotives say that an engine will run well on a 30-degree curve. Is there a standard radius understood, or what do they mean? *A.*—Civil engineers designate curves by degrees, a one degree (1°) curve has a radius of 5,730 feet; a two-degree curve has approximately a radius of one-half as much; a three degree curve one-third, and other degrees a proportionate fraction of 5,730 feet. Hence, to find the radius of a curve given in degrees, divide 5,730 by the number of degrees given, thus: the radius of a thirty-degree curve is $\frac{5,730}{30} =$ 191 feet. 2. If you have not already done so will you please go through the formula for finding the size of cylinders of a compound engine, pressure, power, and revolutions being given. That is to say, I want to guarantee a certain engine to develop 150 horse-power at 110 pounds pressure, condensing, 85 revolutions. I also want to guarantee the coal consumption. *A.*—To design a compound engine and guarantee the horse-power and coal consumption requires an engineer of considerable experience. Many things must be taken into consideration, and to explain all these will take up more space in these columns than we can spare. We must therefore refer you to A. E. Seaton's "Manual of Marine Engineering."

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Friday morning for the ensuing week's issue.

Grant's (1891) gear catalogue ready. See adv. p. 20.

Link-Belting and Sprocket Wheels.
Send for Catalogue of Link-Belting.
Over 50,000,000 feet of Link-Belt in use.
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Light Special Machinery and Tools to order. The Meriden Machine Tool Co., Meriden, Conn.

Audubon Machine Works, New Haven, Conn. Special machinery, heavy and light.

Get particulars of our new Wall, Suspended and Radial Drills. C. H. Baush & Sons, Holyoke, Mass.

Curtis Pressure Regulators. Curtis Return Trap. Curtis Damper Regulator. See Nov. 20, p. 14 Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

Send $1 for Catalogue D, Fine Tools and Supplies. Over 550 pages. Fully illust'd. Free when $10 worth goods are ordered. Frasse & Co., 92 Park Row, N.Y.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

S. W. Card & Co., Mansfield, Mass., make everything in the line of Taps and Dies. S. A. Smith, 23 S. Canal st., Chicago, Western Agent.

For best Return Steam Traps, Pressure Regulators Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N.Y. Send for des'n.

"Roper's Hand-Books," for engineers and firemen. Send for descriptive catalogue. Address Edward Meeks, publisher, Philadelphia, Pa.

Billings & Spencer Co.'s Packer & Boiler Ratchet, & all kinds of Forged Wrenches. S. A. Smith, 23 S. Canal st., Chicago, Western representative.

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Patent Attorney R. G. DuBois, 715 11th street Washington, D. C., procures 1st-class patents for inventors. Send for pamphlet. Guaranteed by Rand, McNally & Co., of Chicago.

Patent Soliciting of High Class.
D. Walter Brown, Counsel in Patent Cases,
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Send for Brief History of Patent Legislation.

Wanted—One or two gentlemen to purchase president's $70,000 interest in incorporated Mfg. Co.; seller will loan company $100,000 to increase business if desired. A. L. B., Carrier 22, Buffalo, N.Y.

Every pattern maker and wood worker should have a Dutton's clipper grinder, No. 5. Send for circular to Montgomery & Co., 105 Fulton street, New York City.

Every draftsman needs one. The Engineer's Sketch Book of mechanical movements, appliances, devices, contrivances, etc., by T. W. Barber. 1,936 illustrations, 8vo. cloth, $3. Catalogue of books on mech. subjects free. E. & F. N. Spon, 12 Cortlandt st., New York.

De Lamater Screw Propeller Wheel made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Stub Ends and Connecting Rods for small connections. Especially adapted for Valve Rod for Steam Engines.
T. C. Dill Machine Co., Philadelphia, Pa.

I think it just the thing for engineers. (Thos. F. Godfrey, inspector; see also AM. MACHINIST, October 23.) Calculations for engineers, firemen and mechanics. By N. Hawkins. M. E. Price, $2.50, or ten parts, 25 cents. Theo. Audel & Co., publishers, 91 Liberty street, N. Y. Catalogue.

Just Ready—New Catechism of the Locomotive. The most complete treatise on the construction and operation of the locomotive, by M. N. Forney. M. E. 688 large pages, with 488 engravings, 6 large folding plates, and 20 full-page plates of various styles of locomotives. Sent by mail, free of postage, $3.50. Frederick Keppy, Scientific Book Publisher, Bridgeport, Conn.

"Binders" for the American Machinist. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co., 96 Fulton st., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 53 East 10th st., New York.

MANUFACTURES.

A. C. Jones, Hot Springs, Ark., will erect a $35,000 ice factory.

An agricultural implement factory will be erected at Cordele, Ga.

The Wilmington (N. C.) Cotton-mills will put in additional machinery.

W. H. Wright is erecting a new iron and brass foundry at Easton, Md.

The Nashua Iron and Brass Foundry, at Nashua, N. H., is increasing capacity.

It is stated that a Canada steel manufacturer will remove his plant to Atlanta, Ga.

Blaine Bros. are reported as enlarging their car shops at Green Cove Springs, Fla.

There is some probability that a steel plant will be established at Clarksville, Tenn.

The Batesville Iron Works, Batesville, Ala., will add a foundry to its machine shops.

Liddell & Co are about to build a large machine-shop and foundry at Charlotte, S. C.

The Tombigbee Iron Works at Aberdeen, Miss., expects to add car works to its plant.

Ground has been broken for the Sheffield (Ala.) Foundry, Machine and Boiler Works.

Pennsylvania capitalists are investigating, with a view to erect car works at Radford, Va.

The Tiffany Iron Works, at Tecumseh, Mich., has been incorporated, with a capital of $50,000.

The organization of a stock company, to erect a cotton factory, is projected at Summit, Miss.

A stock company is reported as having been organized to erect a knitting-mill at Piedmont, Ala.

It is reported that a stock company is being organized to erect another cotton-mill at Florence, Ala.

A stock company will probably be organized at Charlotte, N. C., to establish a foundry and machine shop.

The Coatesville Boiler Works, at South Coatesville, Pa., have been incorporated, with a capital of $50,000.

The Chattanooga (Tenn.) Car and Foundry Company is rebuilding its foundry, which was lately burned.

The Rigby Safety Car Wheel Company is a new organization at Detroit, with a capital stock of $500,000.

E. D. Onion will erect a four-story ice factory at Baltimore, Md., 136x100 feet, with 100 tons capacity per day.

It is stated that an iron furnace will be constructed, and other new industries started at Norfolk, Va.

The Sulzer-Vogt Machine Co. (Louisville, Ky.,) is erecting a plant 168x113 feet, for the manufacture of boilers.

The Ingersoll Mining Machine Company, of Cleveland, will remove their plant to Rockford, Ill., at an early date.

The Baltimore Paper and Pasteboard Company, of Baltimore, will erect large mills near Long Green, Md.

The Wheeling & Elm Grove Railroad has commenced the work of erecting repair shops at Wheeling, W. Va.

D. R Wing & Co., of Little Rock, Ark., will add to their foundry and machine shops a blacksmith shop 50x100.

Jacob Schuehle will, it is stated, erect a factory for the manufacture of his patent ice machinery at Dublin, Tex.

The contract is reported to have been made for the erection of boiler and engine works at Max Meadows, Va.

The Brush Electric Light and Power Co. (Savannah, Ga.,) will put additional machinery in its electric light plant.

The St. Joseph Bridge and Boiler Works has been incorporated, at St. Joseph, Mo., with a capital stock of $42,000.

The new railroad shops of the Pittsburgh & Monongahela Railroad have been commenced at Clarksburg, W. Va.

The Cahill Iron Works, at Chattanooga, Tenn., is reported as enlarging and increasing the capacity of its iron foundry.

The proposed Corpus Christi & South American Railway will, it is reported, erect machine shops in Corpus Christi, Tex.

The Dickson Car Wheel Company, at Houston, Texas, are increasing the capacity of their plant by adding new machinery.

The Richmond Ice Machine Company is building new shops for the manufacture of machines in the suburbs of Richmond, Va.

The Houston and Texas Central Railway Co. will, it is reported, move its Sulphur Springs machine shops to Waco, Texas.

The River Machine Company, of Cleveland, Ohio, will erect an additional machine and boiler shop, 100x80 feet, three stories high.

The Dallas Manufacturing Co. (Huntsville, Ala.,) will, it is reported, erect a second cotton-mill after the completion of its first one.

The Lone Star Ice Company, at Austin, Tex., it is stated, is contemplating establishing a foundry and machine works at Jefferson.

Mr. Farnesworth will, it is reported, organize a $25,000 stock company, to erect an iron foundry and machine shops, in Bristol, Tenn.

The branch of the Cambria Iron Company's Works, located at Cumberland, Md., is being enlarged, and new machinery will be put in.

The Fort Payne Coal and Iron Co. (Ft. Payne, Ala.,) will build, it is reported, 200 coke ovens, and open new coal mines on Lookout Mountain.

The St. Louis, Arkansas & Texas Railroad Co. (office, St. Louis, Mo.,) will, it is stated, erect roundhouse and machine shops at Fort Worth, Tex.

It is stated that the Middlesborough Town Co. will close contract for the transfer of another English iron-working plant to Middlesborough, Ky.

Northern capitalists have purchased $10,000 worth of land in and around Mascot, Tenn., and will build a new town and construct a steel plant.

The Richmond & Petersburg Railroad Company (office, Richmond,) will, it is stated, erect new machine shops and roundhouse at Manchester, Va.

A. E. Randle, Washington, D. C., has purchased the Carrollton, Miss., cotton and woolen-mill property, and will put in new machinery and operate it.

The Lockhart Manufacturing Company, Union County, S. C., is making arrangements to commence work on its $500,000 cotton factory at Lockhart Shoals.

The Tombigbee Iron Works Company, with a capital of $250,000, has been organized at Aberdeen, Miss., by E. M. Ivine, of Grand Haven, Mich., and others.

It is stated that J. B. Northrop is corresponding with Northern parties relative to the establishment of a $500,000 locomotive works plant in Chattanooga, Tenn.

The Brown & Sharpe Mfg. Co. has steadily increased the number of employes, until recently the 1,000 mark was overreached. Business in all departments is good.

The Louisville, St. Louis and Texas Railway Co. (office, Louisville,) is reported as putting $5,000 worth of additional machinery in its Cloverport (Ky.) machine shops.

The Llano Improvement and Furnace Company has, it is reported, contracted with an Ohio party for the erection of a $100,000 machine shop and stove foundry in Llano, Tex.

It is stated that the Nashville, Chattanooga & St. Louis Railroad Co (Nashville, Tenn.,) has completed the erection of its machine shops, and will put in an electric light plant.

The Crucible Iron and Steel Works, East St. Louis, Ill., will nearly double their capacity by the erection of a new foundry 100x64 feet. The improvements will cost $100,000.

The Cardiff Land Company has purchased, it is reported, the iron and nail works of the South Tredegar Iron Company, at Chattanooga, and will remove same to Cardiff, Tenn.

The Richmond Standard Spike Works Company, of Richmond, is reported as having purchased the rolling-mill at Iron Gate, Va., and will enlarge it, and erect spike-mill and car works.

The Sequachee Agricultural Implement Works have been organized at Sequachee, Tenn. The new company have a capital stock of $100,000, and will soon begin the erection of their plant.

The American Mining and Manufacturing Co. has been incorporated in Alabama, with J. C. Kibbey, president, and D. R Keith, secretary, for manufacturing purposes. The capital stock is $25,000.

The Taylor Manufacturing Co., of Chambersburg, Pa., has closed a contract for the removal of its engine works to Bedford City, Va., and a $200,000 stock company is to be organized to operate the plant.

A company has been organized at Carnegie City, Va., with W. A. Carpenter as president, and John Fitch as general manager, to operate a foundry and machine shop, recently erected by these parties.

W. F. Beasley, T. E. Barrett, George Warfield and others have incorporated the Safety Package Company, in Baltimore, Md., to manufacture portable safes, locks, etc. The capital stock is $1,000,000.

The Appleton Manufacturing Company, Philadelphia, Pa., has issued a new circular and price list. Illustrations and descriptions of a great variety of emery grinding machines appear in the catalogue.

The Richmond Standard Spike and Iron Company, of Manchester, Va., has incorporated, with Byrd Warwick, president, and J. T. Anderson, secretary, and, it is stated, increased its capital stock to $240,000.

A big steel plant is expected at Chattanooga, Tenn., to be built by Pittsburgh (Pa.) and Philadelphia parties. It will give employment to over 1,200 men. It is thought that work will be begun early in December.

W. W. Donaldson, Roderick Macrae, A. H. Robertson, and others, have incorporated the Donaldson Macrae Electric Co., at Baltimore, Md., to manufacture electrical machinery. The capital stock is $20,000.

The Franklin-Richardson Co. has been incorporated at Chicago, Ill., by Phillip Clark, K. F Peterson and J. R. Billings for the manufacture of railway devices. The capital stock of the company is placed at $50,000.

The Smith Paper Company, located at Lee, Mass., will soon put new machinery in some of its mills. The machinery will be of the latest approved pattern, and will greatly increase the capacity of the mills.

Joseph W. Lithgow, A. A. Osgood and G. B. Johnston, of Chicago, Ill., have incorporated the Universal Power Co., with capital stock of $1,000,000 The company will manufacture motors, cars and railway appliances.

There is water-works agitation in Seattle, Wash.; Wheatland, Iowa; Austin, Tex.; Kettle Falls, Wash; Halifax, N. S.; Madrid, Neb.; Columbus, Mo.; Orange City, Iowa; Pine Grove, Pa.; Burlington, Wis.; Canton, S. D.

The establishment of a large steel plant on the east shore of the Monongahela River, opposite Charleroi, Pa., is now almost an assured fact, as the land has been bought and paid for. It will cover thirty acres of land.

The McCloud Iron & Steel Company, of Chicago, has been incorporated by S. McCloud, F. G. Holton and W. D. Crossman. The company will manufacture iron and steel articles for railway use. The amount of capital stock is $100,000.

J. M. Blondell, T. E. Hambleton, W. A. House, Jr., and others, have incorporated the Blondell Manufacturing Co., of Baltimore, Md., to erect shops for the manufacture of horse, electric and cable street cars. The capital stock is $200,000.

Work is being rapidly pushed on the machine shops of the Chesapeake & Ohio Company, at Clifton Forge, Va. The main shops, 310x105 feet, are under roof, and the roundhouse, with accommodations for twenty engines, is nearly finished.

Mr. F. G. Niedringhaus, of St. Louis, Mo., according to reports, has placed orders in Pittsburgh, Pa., for the machinery and material necessary to establish a tin plate manufacturing plant in St. Louis, which he expects to have in operation July 1.

The Chicago Tin Plate Company has been organized at Chicago, Ill., with a capital stock of $250,000, for the manufacture of tin plates, sheet-steel, sheet-iron, steel ingots, steel bars and terne plates; incorporators, Richard J. Reis, George O. Manchester and S. W. Snow.

The Brown-Connell iron and steel plant at Youngstown, Ohio, will remove to Hammond, Ind., and establish works to cost $3,000,000, employing 2,500 men. This company has bought the Lakeside Nail Works, and 35 acres of land at Hammond, paying $500,000 for the same.

The Cleland Machine Works Company has been organized, with C. P. Poole, president, and C. W. Poole, secretary, and is reported as having purchased the foundry and machine shops of James Cleland & Son, at Lynchburg, Va., and are to enlarge and improve same.

J. B. Crawford and C. S. Burke, of Boston, Mass; G. A. Smith, of Philadelphia, Pa., and others, have recently organized the Southern Iron and Timber Co. at Newport, Tenn., and will, it is stated, erect six wood-working factories, a tannery, shoe factory, and a $300,000 iron plant.

The several land companies operating at Salem, Va., have appropriated $550,000 for the establishment of a $100,000 rolling-mill, a $75,000 muck-bar-mill, $50,000 iron works, $75,000 for a cotton-mill, and $100,000 for car works. The Salem Development Co. can give information.

The Picard Bridge Gate Company, of Chicago, Ill., has been incorporated for the manufacture of gates for drawbridges, the invention of Arthur Picard. The amount of capital stock is placed at $100,000. The incorporators are the inventor, Napoleon Picard and Louis J. Dennis.

The Watts Iron and Steel Syndicate, Limited, of London, England, is building an open-hearth basic steel works at Middlesborough, Ky., including seven 25-ton furnaces, with all gas producers, blooming mill, shears, etc. The capacity of the works will be 350 tons of slabs and billets per day.

The United States Cold Rolling-mill Company, it is said, has purchased 1,000 acres of land in the vicinity of Hammon, Ind., and is about to erect there a plant for the drawing of wire from cold bar, which will employ 500 men. The stock of the company is placed at $1,000,000. Mr. T. B. Bryan and Mr. Frank Wells are among the principal stockholders.

The latest addition to the industrial plants of Chicago, Ill., has commenced active operations. The Kenwood Bridge Works Company has completed factories on grounds adjoining the tracks of the Fort Wayne Railroad. The bridge company has just finished the main factory building, and will employ about 200 hands in the manufacture of structural iron.

Middlesborough, Ky., is to have a new plant for the manufacture of steam and water registers. Mr. M. T. Holland, of St. Louis, is interested in the new enterprise. He has at present three sash factories, one in Springfield, Ohio, one in St. Paul, Minn., and another in Michigan. The three will be consolidated and moved to Middlesborough. Cheap raw materials was the principal inducement to the change.

Pedrick & Ayer, Philadelphia, Pa., have issued a 66-page catalogue of universal milling machines, portable and stationary cylinder-boring machines, boring bars, Richards' open-side planing machines, etc. The catalogue is artistically printed on a fine quality of tinted paper, and is profusely illustrated, the illustrations being not only of the machines themselves, but the way they are used in doing a large variety of work. The catalogue is interesting and instructive, besides being a work of art.

The Arcade File Works, the oldest existing, and one of the largest and most enterprising concerns in the country, located at Sing Sing, N. Y., are considering the advisability of moving their entire plant to a location where increased facilities for manufacturing may be had. They find this step necessary owing to the steady growth of their business, and lack of space in which to extend their works. The concern employs about 150 hands, and propose to enlarge so as to double the production.

The Indiana Steel Company will not build its extensive plant in Wabash, Ind., this winter, notwithstanding the fact that the citizens have given the company a bonus of $35,000, free land, and natural gas at low rates. The contract was signed several weeks ago, and it was thought the buildings would be under roof in December, but the stockholders allege that the recent election gives little assurance of the retention of high duties on steel, and they propose to pay all losses accruing to the Wabash Board of Trade, and to the firms which have machinery contracts, and abandon the scheme.—*Chicago Tribune.*

A Boiler Explosion.

A correspondent sends us a newspaper clipping—we do not know from what paper taken—which relates to a judicial inquiry into the cause of a boiler explosion. He asks our views as to the opinion of one of the witnesses, that the explosion was caused by the formation of gases in the boiler. This witness is reported as saying:

I find that the water in the boiler at the time of the explosion must have been very low. This being the case, it caused the steam to raise very rapidly from the hot fire which had been built under the boilers. This agitated the water against the sheets, forming gases. These gases expanded, creating a great pressure, and of course the explosion followed. The plates directly above the fire, and about five feet from the door, show signs of being scorched. This crystallized the iron, making it very brittle, naturally causing a weakness at that particular place.

If this witness means by "gases," anything more than steam pressure, pure and simple, we do not believe he is right. If our correspondent will look further at the testimony, he will find the following, which, it seems to us, amply accounts for the explosion:

I have run the engine at times. Understood the injector, and never had any trouble with it. It always worked. The last time I ran the engine was last Thursday. Both boilers leaked, one worse than the other, the one that exploded being the worst. Can't say how long they leaked; think two months at least; nothing done to them since then that I know of. I ran on Monday, Tuesday and Wednesday of last week, and had trouble to keep up steam. This was because I had to keep the injector on all the time. The safety valve was set at 85 pounds. Steam never blew off while I was engineer. Water would run down during the night. On Tuesday I kept the injector on all day, except about 30 minutes, because the boiler leaked so badly. It leaked in two places at the seams. I carried 50 pounds of steam and no more. I was afraid to carry any more. The boilers were fixed in June; that is, they put in new rivets. I always tried to hold the water between the middle and upper gauge. On Monday I said to the foreman: "The boilers leak very badly." He replied: "It is too bad." On Saturday, when I drew the fire, the water was up to the gauge. [The upper gauge, we suppose.] On Monday, when I came to the works, the water had dropped to the lower gauge. The space between the lower and upper gauges is seven inches. Sometimes I had trouble with the injector, but on Monday it worked all right. The water ran from the boilers so rapidly that the fire would not consume it. The leaks were on both sides; the one nearest the other boiler was the worst. Could not raise water from the lower to the upper gauge while running the engine.

And the following from another witness:

I heard Samuel Epler say that he was going to put something in the boiler. He took off the manhole, and said he was going to put more manure in the boiler, also bran, to stop the leak.

In the face of such testimony as this it does not seem necessary to revive the ancient gas theory to account for the explosion, and further comment would be superfluous.

The Height of Waves.

It is not uncommon in prose works to read of mountainous waves. Exact measurements seldom confirm first impressions. Scoresby found that 40 feet was the height from trough to crest of the largest waves measured by him in the North Atlantic and in a cyclonic storm, when bound for Australia in the Royal Charter. This has long been accepted as the extreme limit of wave height. Capt. Kiddle, a well-known and experienced navigator, has, however, encountered waves at sea which were 70 feet high.

The late Admiral Fitzroy had previously observed waves as high; and some observations made at Ascension in 1836 support these authorities. In 1844 her Majesty's ship Inconstant was scudding with her stern upon the crest and her bow in the depression between two successive waves, and the wave ahead was observed exactly level with her foretopsail yard, just 77 feet above the water line.

On the 27th of July, 1888, the Cunarder Umbria was struck by a wave not less than 50 feet high, which did much damage. Two days before, the Wilson liner Martello had a

similar experience; an enormous solitary wave struck her, completely submerging the decks. The Martello was much smaller and more deeply laden than the queeenly Umbria. No connection could be traced between these waves, which were referred to in the dailies as tidal waves, although of altogether different origin. In October, 1881, the Italian bark Rosina had all hands, except one man who was ill in his bunk, swept off her decks by a wave which broke on board as they were shortening sail during a heavy squall in mid-Atlantic. The British bark Undine had one watch washed overboard and her captain killed under similar circumstances. It is said that the massive bell of the Bishop Rock was wrenched from its fastenings by the momentum of driving seas in a gale of wind, and the gallery containing it thickly strewn with sand, although 100 feet above high-water mark. Scoresby gave 600 feet as the maximum length of sea waves, but there are many longer. Mr. Douglas, when building lighthouses on the coast of Cornwall, noticed waves 1,300 feet long from crest to crest.—*Chambers' Journal.*

Annealing Mushet Steel.

Recently we published a letter from a well-known machinery firm in this city, in which it was stated that there was a process by which Mushet steel could be annealed, but it was believed the process was a secret one. Since then we have received a circular from B. M. Jones & Co., 11–13 Oliver street, Boston, Mass., who are the sole agents for the sale of this steel in the United States. This circular contains "directions for treating the 'R. Mushet's special steel' to make it adapted to the following uses: For milling cutters, taps and dies, reamers, rose-bits, countersunk drills and twist drills." Below we publish these directions, believing they will be of interest to our readers:

After the steel is forged, heat it up thoroughly to a light yellow (short of burning), and bury it in hot ashes from the smithy fire, or in lime, and cover over with fine ashes or sawdust, so as to exclude the air thoroughly till perfectly cold. The steel will then be annealed for turning, filing, etc., etc., but if it is found to be hard below the surface when cut into for working, it may be necessary to anneal again before finishing.

To harden it again: This may be done with the entire piece, or in any one part of the piece, leaving the rest annealed, viz.:

For hardening milling cutters: Heat up to a bright yellow (short of burning). If the "cutters" are thin, cool in the air, suspended by a wire. If they are thick, they should be cooled quicker by holding them over a strong cold-air blast-pipe, and kept slowly revolving in the blast till cool.

For hardening taps and dies: Heat a tap quickly upon the threads (which always catch the heat first) and cover quickly with the cold-air blast; afterwards heat the "square" at the shank of the tap to a good red, so as to harden it sufficiently for use.

This same treatment will apply to reamers. For long taps and reamers there is not the trouble of "twisting" that there is in water-hardening steel.

For hardening screwing dies: Heat them quickly on the thread, and cool them in the cold-air blast.

The above will indicate the treatment for the hardening of other articles.

Local hardening: Take care to cover the parts that are intended to be left annealed with clay, or any "composition," say asbestos, and heat the exposed part, which is intended to be hard, and cool quickly in cold-air blast.

For hot punching and cold punching, the steel should be annealed and hardened at the point.

For shear blades for cutting hot iron, the steel should be annealed and hardened on edge.

For wearing parts of heavy machinery, the steel should be annealed and hardened.

The "R. Mushet's special," when hardened after annealing, neither contracts nor expands nor alters in form, as does all water-hardening steel.

The Measurement of Power.

By J. J. FLATHER.

FOURTH PAPER.

Another form of absorbing dynamometer is that designed by Mr. C. B. Richards, now professor of mechanical engineering at the Sheffield Scientific School. It consists of a tank *A B*, Fig. 4, within which two paddle-wheels revolve in oil, thus producing a resistance and a tendency to rotate the whole tank, which is mounted on friction rollers. This tendency to rotate is measured by the lever arm acting on a platform scale. By means of the valve *v*, the oil in the tank can be allowed to circulate with greater or less freedom; by closing the valve a pressure is brought to bear on the oil in the tank, so that the resistance to the rotation of the inner wheels thus becomes a drag on the driving power; when the maximum resistance is obtained without decreasing the number of revolutions per minute of the shaft, the force of resistance, measured on the scale beam, will enable us to calculate the horse-power consumed. In order to prevent any change of temperature in the oil, a constant stream of water is discharged onto the tank through a perforated pipe *P*, above it. Beneath the tank proper a metal receiver *R* catches the water, which is then carried off by the waste pipe *W*, shown at the bottom of the receiver.

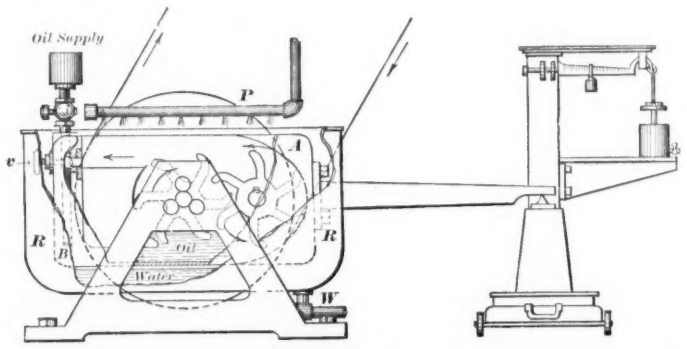

Fig. 4.

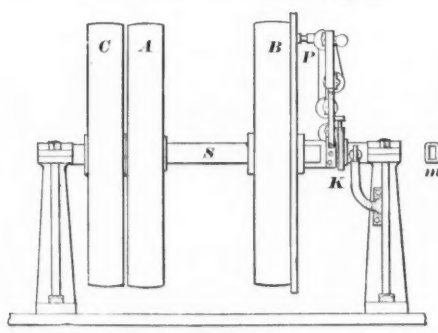

Fig. 5.

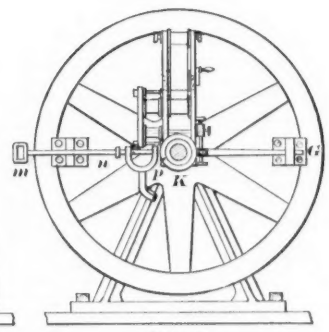

Fig. 6.

THE MEASUREMENT OF POWER.

Part of the tank *A B*, and also of the outside receiver *R* is torn away in the figure, in order to show more clearly the circulation of oil and position of the paddle-wheels. One of these latter is mounted on the pulley shaft, and has the same direction of rotation as the belt pulley; the other is driven by a gear (not shown), and revolves in the opposite direction. A casing at each end of the tank fits close to the paddle-wheels, the blades of which roll on each other. In this respect the internal arrangement is similar to that of various rotary engines and blowers. In order that there should be a minimum amount of vibration of the scale beam while weighing the pressures, a rod and dash-pot were used—the latter being supported by an arm attached to the side of the scales.

The size of this dynamometer was 30″x14″ x18″, and would measure from ¼ to 14 horse-power.

With this apparatus, as with the Prony brake, it will be seen that an absorbing dynamometer cannot be used to determine the power which is actually transmitted to a machine; it can only measure the power which is produced in circumstances as similar as possible to those under which the machine is operated; and this power is assumed equivalent to that consumed by the machine.

Another form of absorption dynamometer by which also any desired load can be maintained on the engine, has been recently brought out by Prof. Alden, of Worcester. This dynamometer is essentially a friction brake in which the pressure causing the friction is distributed over a comparatively large area, thus giving a low intensity of pressure between the rubbing surfaces.

This friction is produced by the pressure of water from the city pipes acting upon two copper plates in contact with a smooth cast-iron disk keyed to the shaft which revolves in a bath of oil between the plates. These latter are secured by a water-tight joint to a casing which does not revolve, and to which is bolted a lever arm carrying weights as in an ordinary Prony brake. The shell or casing is so constructed that it permits an equal pressure of water upon both sides of the disk—a sufficient quantity of the water being allowed to pass through the machine to carry off the heat due to the energy absorbed.

An ingenious form of valve operated by the slight angular motion of the dynamometer varies the supply of water, and consequently the pressure between the frictional surfaces, thus securing automatic regulation.

Half a century ago, Morin gave as the requirements of a dynamometer the following, viz.:

First.—The sensibility of the instrument should be proportioned to the intensity of efforts to be measured, and should not be liable to alterations by use.

Second.—The indications of flexures should be obtained by methods independent of the attendance, fancies, or prepossessions of the observer, and should consequently be furnished by the instrument itself, by means of tracings, or material results, remaining after the experiments.

Third.—We should be able to ascertain the effort exerted at each point of the path described by the point of application of the effort, or, in certain cases, at each instant in the period of observations.

Fourth.—If the experiment from its nature must be continued a long time, the apparatus should be such as can easily determine the total quantity of work expended by the motor.

To meet these conditions, Morin made the spring dynamometer, in order to obtain the magnitude of a force, as, for instance, the traction of a horse on a loaded wagon, canal boat, etc.

In this dynamometer a force was measured by the flexure produced by it on two springs supported at their ends, and loaded in the middle. When a steel bar of rectangular cross-section is placed freely upon two supports, and subjected in the middle to a force *P* perpendicular to its length, its flexure, *s*, so long as it does not exceed the limits of elasticity, will be:

First.—Proportional to the effort *P*.

Second.—Proportional to the cube of the arm of the lever *l* of this effort.

Third.—In an inverse ratio of the width of the bar *b*, in a direction perpendicular to the plane of flexure.

Fourth.—In an inverse ratio of the cube of the thickness of the bar *h*, at its middle point.

Fifth.—In an inverse ratio of the modulus of elasticity, *E*, for the material of the bar.

The deflection for the force *P* will be, therefore:

$$s = \frac{P\ l^3}{W\ E} \times \frac{1}{48} =$$

equation of elastic curve, or, since

$$W = \frac{b\ h^3}{12} =$$

moment of flexure for rectangular strip, we have for deflection:

$$s = \tfrac{1}{4}\ \frac{P\ l^3}{E\ b\ h^3}$$

Since we have to take into account the deflection of two springs,

$$s = \tfrac{1}{2}\ \frac{P\ l^3}{E\ b\ h^3}$$

Now, if the longitudinal profile of the bar is parabolic, the flexure will be double that of a spring of uniform thickness, while the strength remains the same. Hence we have:

$$s = \frac{P\ l^3}{E\ b\ h^3} = n\ P,$$

where *n* is a number to be determined by experiment.

If in the construction of a spring dynamometer, known weights be applied, and the deflection *s* observed, the number *n* can be calculated and used in the construction of a scale. Morin found that with good steel the deflection may reach one-tenth of the length of the spring before the relation between it and the force changes.

In order to meet the second, third and fourth requirements above mentioned, a self-registering apparatus was used, by which the work performed was traced upon a continuous roll of paper, set in motion by suitable wheel work. When required to determine the force of rotation of a shaft or pulley the above dynamometer requires modification; the essential features, however, remain the same.

The following description illustrates the application of the foregoing principles to the rotation dynamometer.

Upon a shaft resting on two cast-iron supports are three pulleys of the same diameter, Figs. 5 and 6. *A* is fixed, *C* is loose, and *B* is movable around the shaft beeween the limits which we shall indicate. This apparatus being placed between the driving shaft and a machine whose resistance is to be measured, the loose pulley *C* receives the power from the driving shaft by means of a belt, which, when transferred to *A*, sets the shaft *S* in motion.

The pulley *B* is free on the shaft, and is connected to it by means of two parabolic springs which are fastened to the shaft, and at the end *G* to the rim of *B*. These springs turning with the shaft deflect more or less, according to the resistance encountered, and when the resistance to flexure overcomes the resistance of the machine, motion is transmitted through the springs to *B*.

Upon the shaft is a worm *K* having a stop *p*, so that by means of a sliding bar *m n* it may be prevented from revolving with the shaft during the experiment. By a suitably arranged train of gearing a series of drums is set in motion, by means of which a roll of paper is caused to pass under a pencil *P* attached to one of the arms of pulley *B*, thus recording the resistances, and giving a measure of the work performed.

Using the same notation previously given, and substituting *R*—radius of path in feet—for *L*, we have the work done

$$W = 2\ \pi\ R\ N\ P;$$

where *P* = resistance overcome in the machine driven by the dynamometer. *P* can be

NOTE.—About the year 1873, Mr. Richards used this principle of measuring the tendency of the belt to rotate a body about its axis, and designed a stand or cradle upon which the machine itself was suspended on trunnions. When the machine to be tested was put in motion its tendency to rotate thus became a measure of the resistance.

This same device was introduced by Prof. Brackett, of Princeton, a number of years later, and is now very generally and successfully used in testing dynamos.

readily ascertained when deflection of spring is known.

One of the principal objections to the use of this instrument is that the centrifugal force of the rotating pieces enters as a factor into the final result; for accurate work this would necessitate corrections for different speeds, and in this respect Morin's dynamometer does not fulfill his third requirement of a good instrument, viz.: "We should be able to ascertain the effort exerted at each point of the path described by the point of application of the effort, or, in certain cases, at each instant in the period of observations."

Accident Insurance in Shops.

In our issue of November 13th we published a circular issued by the Brownell & Co., of Dayton, Ohio, to their employes, inviting them to participate in a plan of accident insurance evolved by the company. It looked like a fairly good plan, but it appears that the workmen did not respond as readily as was expected. This has induced the company to issue another circular (at least another circular comes to us under the Company's heading and over its signature, the authenticity of which we have no reason to doubt), in which are embodied some features that appear to us to be decidedly objectionable.

We had supposed in the instance of the first circular that there was to be no attempt at compulsion in the matter; that the men were to be at perfect liberty to do as they pleased. But by the terms of the second circular it appears that fifty cents is to be "deducted from the pay of *each* and *every* [we give the emphasis of the circular as it comes to us] employe on the last pay day of each month, to apply as payment for accident insurance."

This is one of the features we believe to be entirely wrong, to wit, forcing accident insurance upon workmen. We suppose if the company decreed that it would not employ men unless they belonged to the Catholic or the Methodist Church, according to its taste in the matter, it would not be legally responsible. Probably an action for religious persecution would not lie against it. Similarly it can discharge its employes unless they invest in an insurance scheme, but the legal power to do so does not make such action right or good policy.

Many men do, and all have a right to object to such insurance. And no one has a moral right to coerce them in the matter.

Another arbitrary feature is worded as follows:

"Notice is herewith given that Dr. A. E. Jenner is the physician, and any one injured *must be attended by him.*"

Dr. Jenner, so far as we know, is an excellent physician and surgeon. He may be the very best in Dayton. But there is a world of prejudice in such matters. However high Dr. Jenner may rank, there are undoubtedly men in Dayton who would not accept his services under any reasonable consideration. And nothing goes farther than prejudice in the physician's art. It is, in our opinion, both ridiculous and arbitrary to ask men to accept and pay for the services of any particular doctor.

We believe that a well prosecuted attempt to force workmen into an insurance scheme—or any other scheme—will result in filling a shop with an undesirable class of men. A man without independence enough to insist upon doing some thinking for himself is not likely to amount to much as a mechanic.

The new steamer "Boston," that sails between Boston and Yarmouth, N. S., is credited with a speed of more than 18 knots. She was built on the Clyde, and her guaranteed speed was 17 knots.

Machinists' Supplies and Iron.

NEW YORK, December 6, 1890.

Iron—American Pig—Several causes seem to have been acting together to cause a dull market and somewhat lower prices, especially for Southern brands. The recent financial disturbances have undoubtedly had some effect upon buyers, especially those who are using iron in the production of anything used by railroads. There seems to be some expectation also that the prices which are soon to be quoted by the leading furnace companies for next year's deliveries will be somewhat lower than the present ones, and this has a tendency to make buyers conservative.

We quote No. 1 Foundry, standard Northern brands, $17 to $18; No. 2, $16 to $16.50; Grey Forge, $15 to $15.50; Southern brands No. 1 Foundry, $16.50 to $17; No. 2, $15.75 to $16.

Scotch Pig—Nothing new that is worthy of note has transpired during the week, the demand continuing quite moderate, and sales confined to small lots.

We quote Coltness, $24.50; Dalmellington, $22 to $22.50, and Eglinton, $20.50.

Copper—The supply seems at present to be considerably ahead of the demand, and it is thought there are considerable accumulations of stock. The Lake companies ask 17c., but outside parties are selling at 16c. to 16¼c.; Casting brands, 14c.; Arizona, 14¾c.

Lead—The market has been dull and quiet, with very little trading going on. Prices are lower, sales having been made at 14½c.

Spelter—The demand for Western is moderate. Values show no change of importance.

We quote ordinary brands of Western at 6c. to 6⅛c.; choice, 6¼c. to 6¼c.; refined, 7¾c. to 8c.; Silesian, 7⅝c. to 7⅞c.

Tin—Little change has taken place during the week, the market having ruled dull, with very little fresh business. Prices are at 20⅛c. to 20⅝c.

Antimony—The market has ruled steady and quiet.

We quote Hallett's, 17⅛c.; Cookson's, 19⅛c. to 19¾c.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted—Situation by a steady, sober machinist; married; prefer engine works and piece work in North or West. Address Lock Box 252, Akron, Ohio.

Wanted—Position by a practical boiler maker, as foreman; sober and steady man; good references. Address J. H. C., AMERICAN MACHINIST.

Boiler maker (53) wants position; understands laying all kinds boiler, tank and gas work; 3 years' experience as foreman. Box 15, AM. MACHINIST.

Position wanted by 1st-class draftsman, with good experience in steam engine work, marine eneineering, sugar refineries, steel works, designing of factories, ice & mining machinery. Box 16, AM. MACH.

Wanted—Position as superintendent or foreman; familiar on general machine work; good manager and pusher; has handled large bodies of men. Address Box 13, AMERICAN MACHINIST.

Wanted—A competent man as foreman in a machine shop, must be a good draftsman and capable of handling men, also in getting out 1st-class work promptly. Address M. E. B., AMERICAN MACHINIST.

Wanted—Mechanical draftsman, one familiar with crane construction preferred. Address, giving age, experience and references, The Yale & Towne Mfg. Co., Stamford, Conn.

Wanted—A situation as carpenter and pattern maker in machine shop or foundry; competent to take charge; fair draftsman. Address Jackin, AMERICAN MACHINIST.

Mechanical engineer, possessing theoretical knowledge, several years' varied experience, business and executive ability, desires responsible position. S., P. O. Box 321, Chicago, Ill.

Wanted—Immediately, 5 good machinists for machine shop. Tool and floor hands, and two men capable of taking machinery out, and erecting same when built. Apply or address at once to Kenney & Co., Scottdale, Pa.

Wanted—A prominent firm of engine builders seeks another situation for its present foreman of foundry; a capable man, of long and successful experience, who leaves their service for satisfactory reasons. Address Box 96, AMERICAN MACHINIST.

Wanted—Contract to erect or take charge of machinery of any kind; in Spanish America preferred; have had several years' experience in Spanish America; speaks Spanish; best references. Address Box 14, AM. MACHINIST.

Wanted—Superintendent for machine shop, foundry and boiler works; one who is familiar with all branches of the business, is a good draftsman and designer, and can handle men. State experience and salary expected, and give references. Address "Superintendent," care of AM. MACHINIST.

Wanted—Position as superintendent or draftsman, by an American, age 33; a practical mechanic, experienced on machine tools, special machinery, sheet metal working machinery, rolling-mill machinery, and in charge of men; 16 years' experience. C. Lewis, No. 32 Fourth st., Birmingham, Conn.

Wanted—By Jan. 1st., a position by a mechanical engineer and draftsman; thoroughly posted on high speed and compound engine design, and best practice in steam and electric plants; has wide shop experience, both in shop details and handling men. Address T. B, AMERICAN MACHINIST.

Foreman wanted for machine shop, employing at present about 16 men; manufacturing a specialty; one who can handle men to an advantage, and will begin on moderate wages, good position is offered; salary will be increased as business increases. Address H, AMERICAN MACHINIST.

Wanted—Practical engineer, with not less than $5,000 capital, to take hold and manage a foundry and engine business running on stationary and pumping engines, and doing good repair trade; lately started on refrigerating machinery; advantageous arrangements will be made with energetic man. Address "O. B.," AMERICAN MACHINIST.

Superintendent—A competent mechanical engineer with good record, now in charge of large works, wants to make a change. Good manager of men; well acquainted with best shop practices and systems. Experienced in marine and stationary engines and boilers, and general machine work. Address A. H. R, 144, AMERICAN MACHINIST.

Wanted—An active man as superintendent, by a manufacturing company in railway line; must be thoroughly familiar with the best practice in manufacturing, both in wood and iron; the plant is of good size, modern, splendidly equipped, and the business growing very rapidly; the opportunity is a rare one for a first-class man. Address J., AMERICAN MACHINIST.

Wanted—By Jan 1, a position by a practical machinist, accustomed to handling large bodies of men, on engine work and machine tools; has traveled very extensively for eight years in and out of the United States in the interest of a well-known engine company; is well up on high-speed and compound engines for electric light and street railway work, and can make estimates on the same, including installation; Pacific coast preferred. Address Salesman, AMERICAN MACHINIST.

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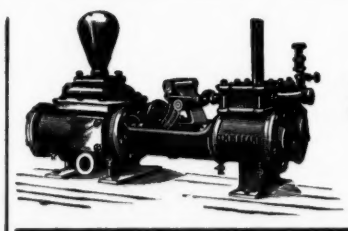

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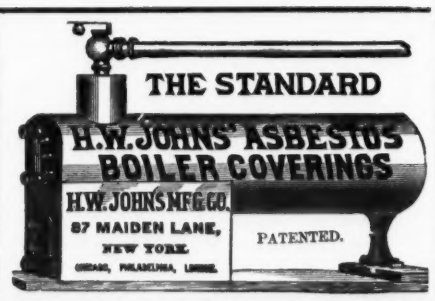

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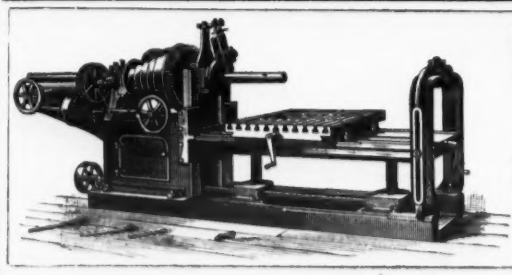

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Wanted—Customers for our new Radial Drills, C. H. Baush & Sons, Holyoke, Mass.

Wanted—A second-hand shears of capacity for cutting iron 2½x4 inches. Address P. O. Box 1358, New York.

For Sale or Lease—Well-established machine shop and foundry in a gas city of 12,000. Address A. X., care of AMERICAN MACHINIST.

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Wanted—Six or seven-foot second-hand vertical boring mill; 48"x10 foot second-hand planer; 36"x 10 foot second-hand lathe; and other machine tools. Address Suligut, AMERICAN MACHINIST.

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For Sale—Bound volumes of the Patent Office Gazette for years 1883, 1884, 1885, 1886, 1887 and 1888. Price, $4 per year. Address J. C., care of AMERICAN MACHINIST.

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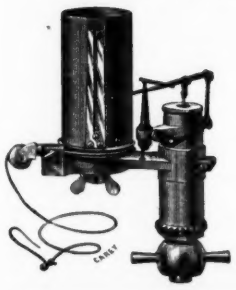

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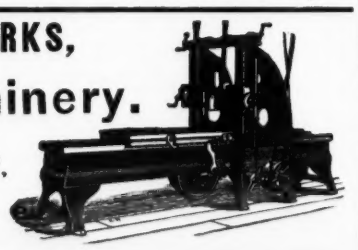

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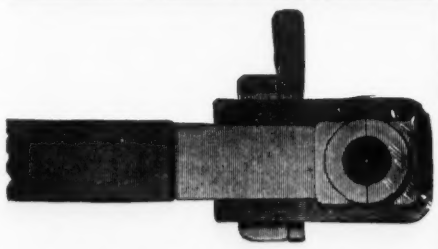

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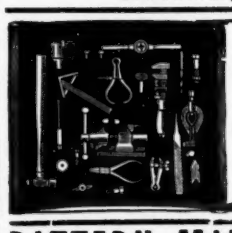

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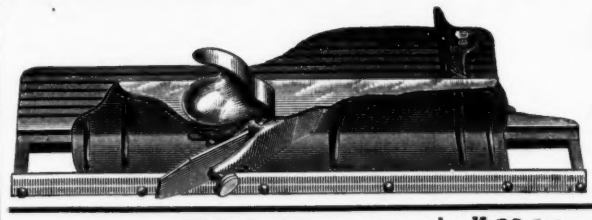

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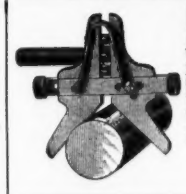

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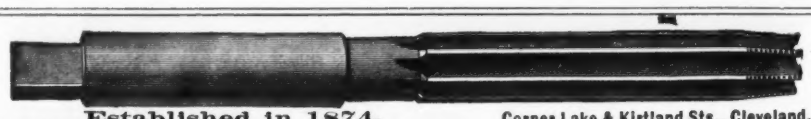

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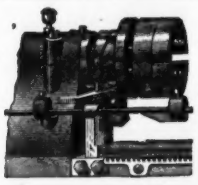

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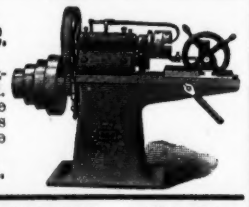

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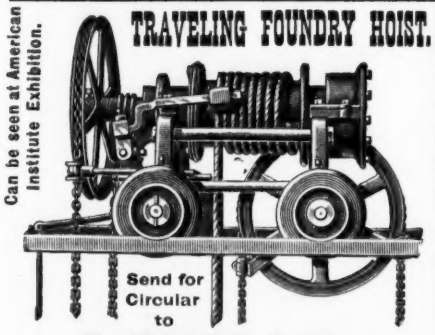

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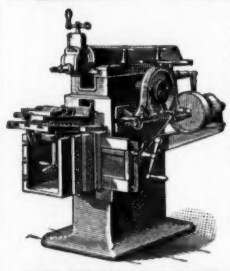

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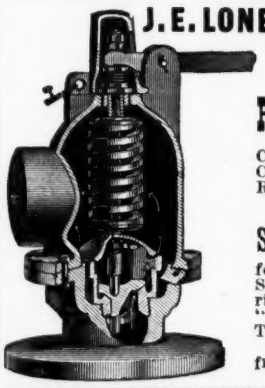

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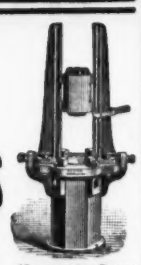

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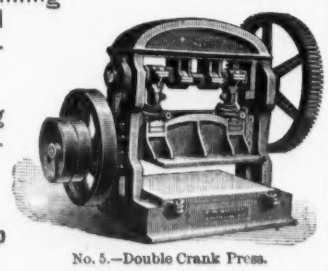

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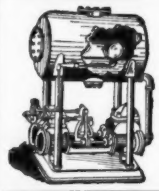

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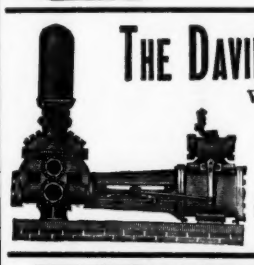

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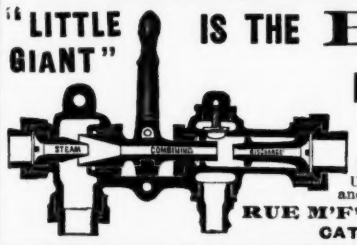

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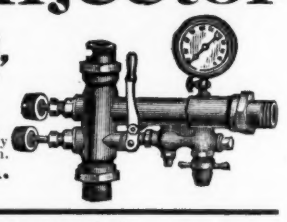

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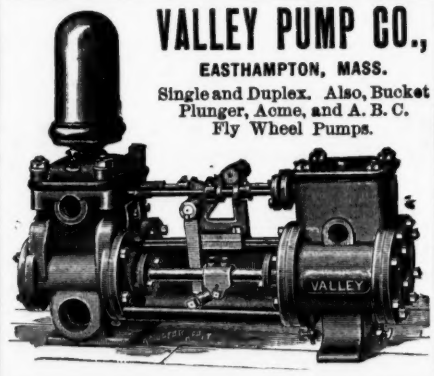

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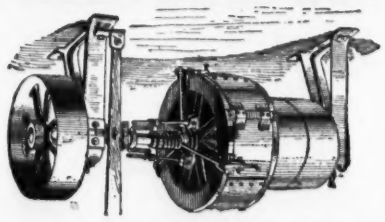

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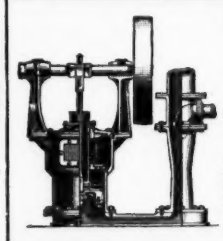

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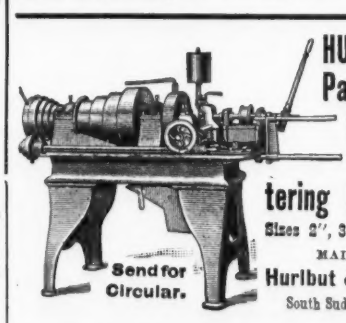

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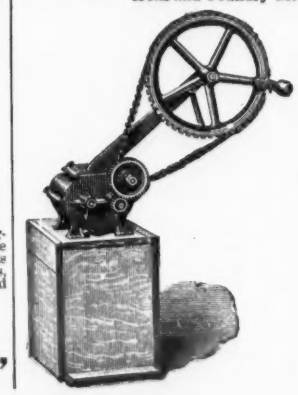

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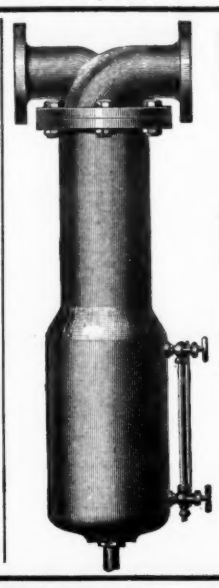

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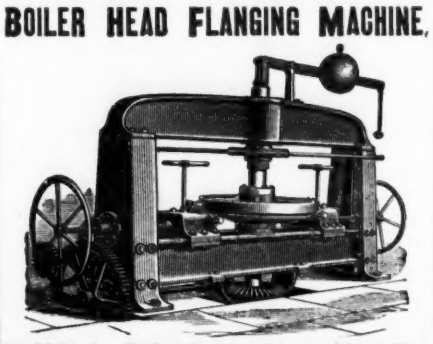

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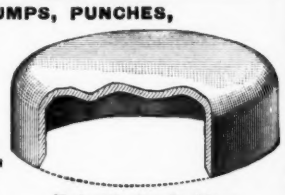

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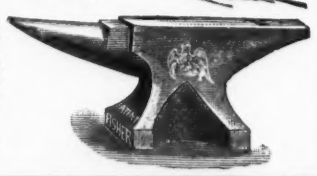

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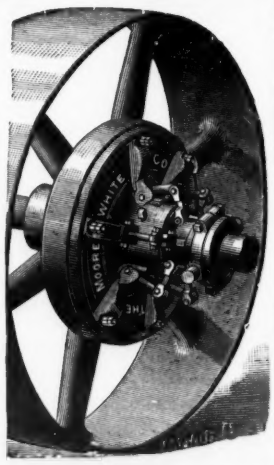

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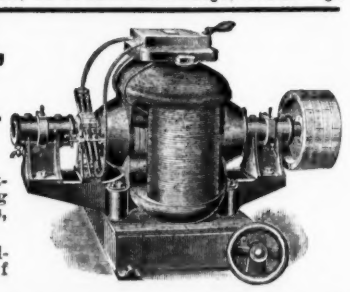

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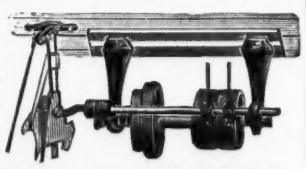

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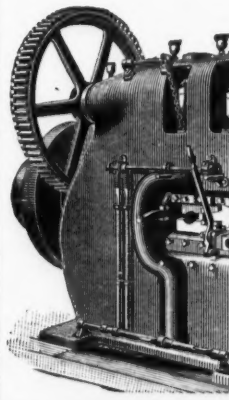

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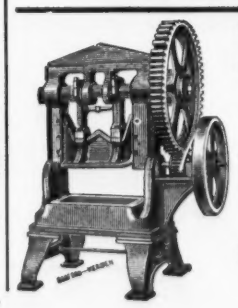

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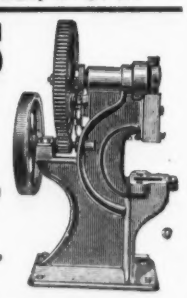

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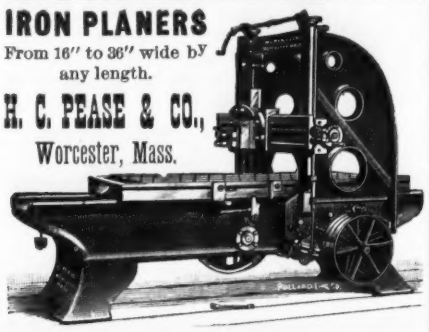

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All Sizes from 16 in.x16 in.x4 ft. to 36 in. x36 in.x12 ft. inclusive carried in stock.
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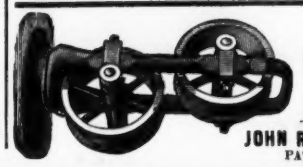

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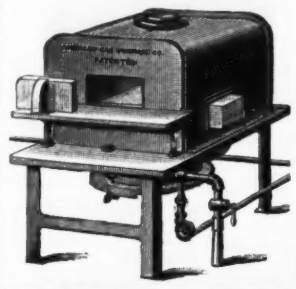

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GAS BLAST FURNACES.
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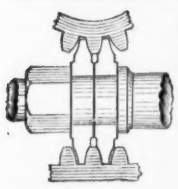

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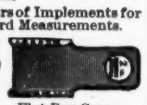

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STEEL CASTINGS
FROM 1-4 TO 15,000 LBS. WEIGHT.
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Stronger and more durable than iron forgings in any position or for any service whatever.
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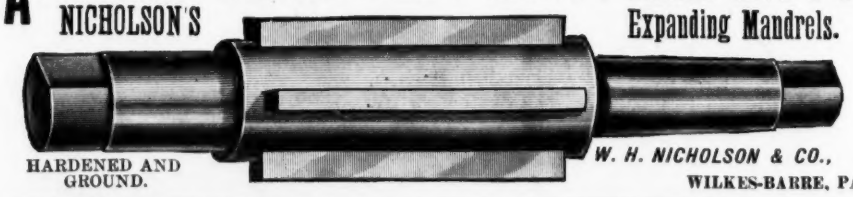

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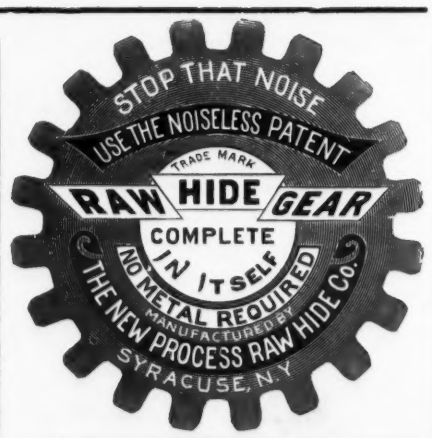

Our new Machine is complete and for sale. It will bore a cylinder 9″ x 20″ down to a $\frac{1}{10}$″ hole absolutely true; drills any number of holes at any angle without removing the work, laying out its own measurements to $\frac{1}{1000}$″ and 1 minute angle. Drill is guided in a bushing to the surface of the work. It taps by power or hand through the hollow spindle in the positive line of the drill. As a Universal Milling Machine it is of larger capacity and stiffer than any made. Arbors 20″ long can be used. Dividing head of entirely new pattern and new automatic feed. As a gear cutter it has no equal, cutting spur, bevel, spiral and worm gears up to 30″. Will make spiral drills, reamers, cutters, jigs, gauges and special tools of any sort with accuracy. Designed as an accurate, reliable tool on the finest work as well as the largest. Your examination of the machine at work solicited at our shops, R. R. Place and Commerce St., Newark, N. J.
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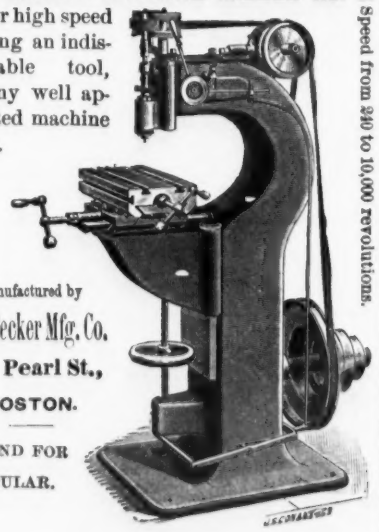
For high speed milling an indispensable tool, in any well appointed machine shop.



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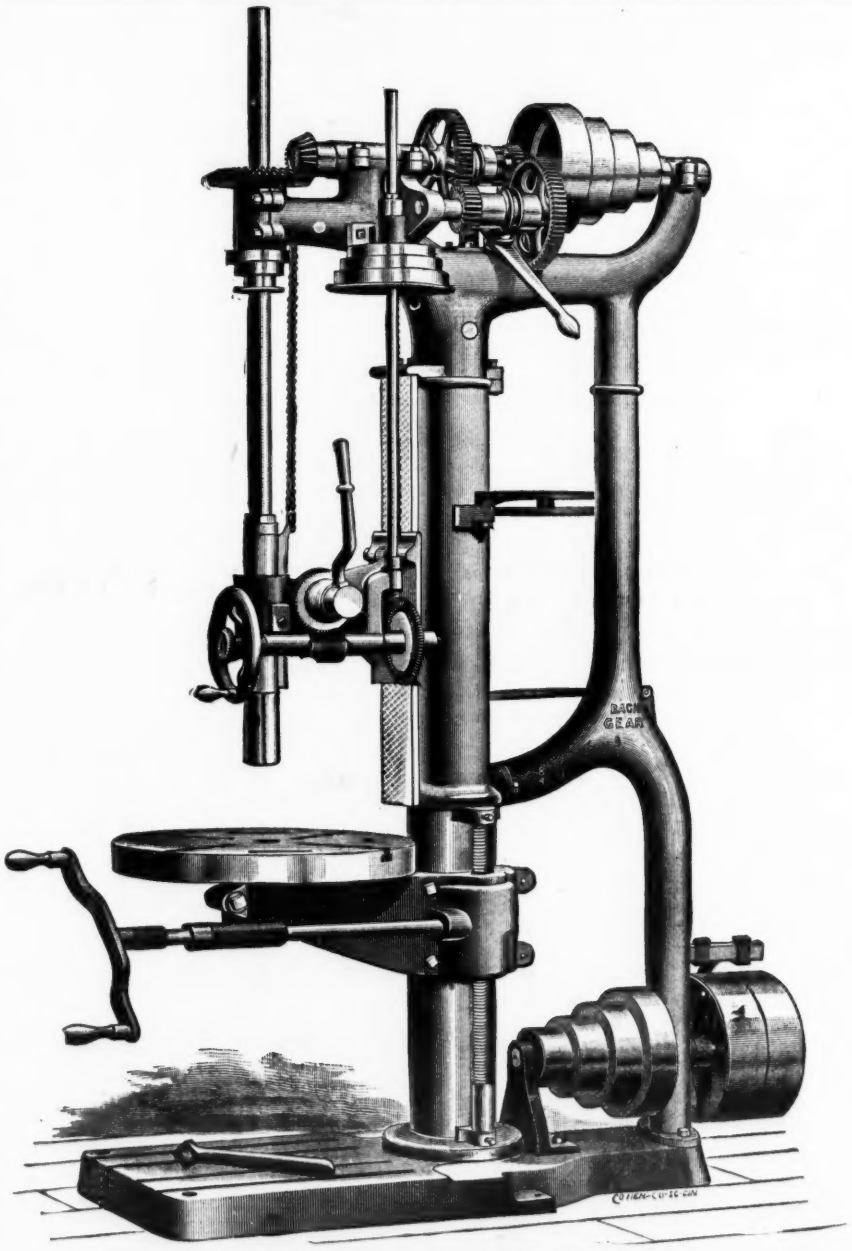
Grinding Machinery for all purposes. Over 100 different patterns.



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FEATURES:
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☞ Gibbed heads, operated with rack and pinion.
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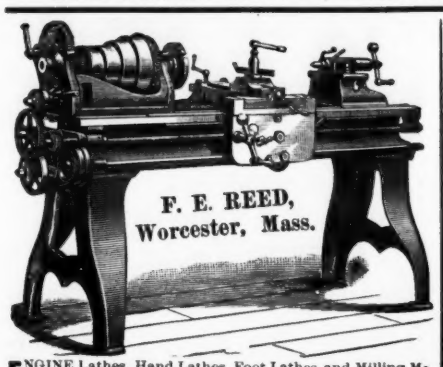
Manufacturers of Morse Patent Straight-Lip Increase Twist Drills.

Solid and Shell Reamers, Beach's Patent Self-Centering Chuck, Bit Stock Drills.
DRILL GRINDING MACHINES, MILLING CUTTERS AND SPECIAL TOOLS TO ORDER.



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14, 15, 16, 18, 20, 24 and 28 INCH SWING.
ANY LENGTH OF BED DESIRED.
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Manufacturers of and Dealers in
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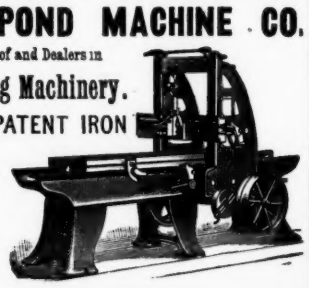

POWELL IRON PLANERS,
For Immediate Delivery.
One Planer 30 in.x30 in.x10 ft.
One " 36 in.x36 in.x12 ft.—2 heads.
One " 48 in.x48 in.x14 ft.—2 heads.
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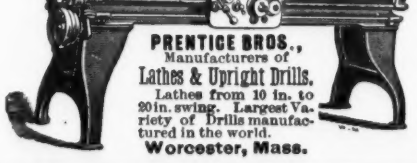
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Manufacturers of
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Lathes from 10 in. to 20 in. swing. Largest Variety of Drills manufactured in the world.
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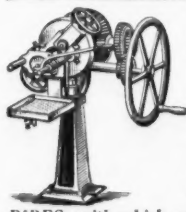

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"ECLIPSE" Nos. 2 and 3. These are powerful and most efficient machines for cutting large PIPES, with which one man can easily cut off and thread 6-inch pipe.
No. 2 Cuts and Screws 2½ to 4 in.
No. 3 " " " 2½ to 6 in.
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We also build Power Machines.

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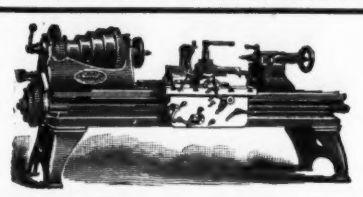
STEEL WIRE OF EVERY DESCRIPTION
SPRINGS



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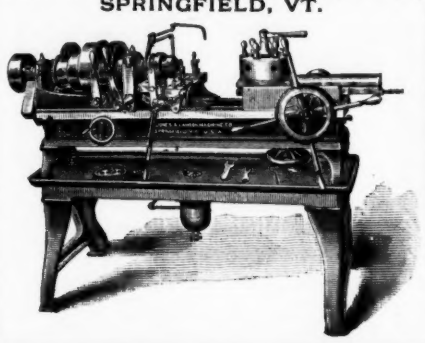

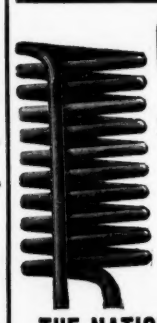

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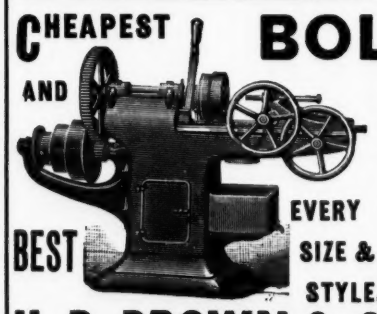

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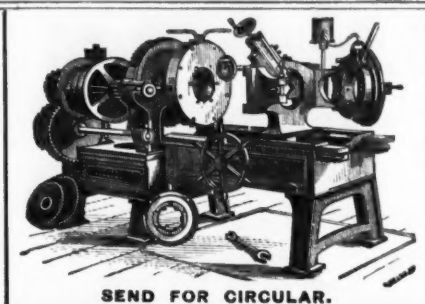
Special facilities for Accurate Work.

Bevel Gears cut theoretically Correct.



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For Pipe, Mill and Steam Fitters' Use.
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For Steam Fitting, also
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The Garvin Machine Co.,
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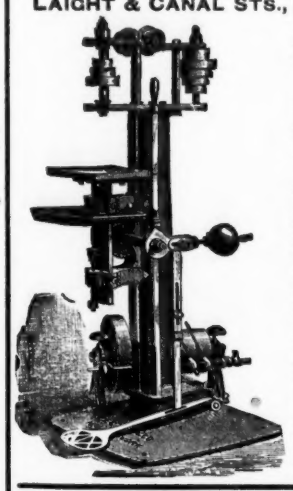
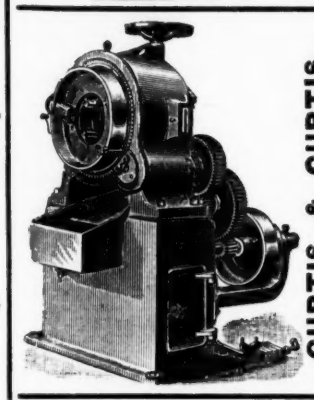
Including Milling Machines, Drill Presses, Hand Lathes, &c.



The machine shown in cut is especially designed for jobbing, and is fitted up with one or two spindles. Those with two spindles have pulley, with two sections, which gives two speeds to each spindle. Those fitted up with one spindle have a cone pulley with three sizes. The back shaft has a cone pulley with four sizes.



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Pipe Cutting and Threading Machinery.
FOR HAND OR POWER.
RATCHET DRILLS, RATCHET DIE STOCKS AND MALLEABLE IRON PIPE VISES

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THE CINCINNATI MILLING MACHINE CO.
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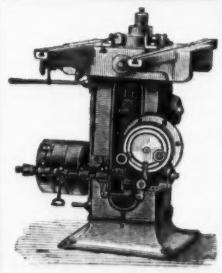

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RACK-CUTTING ATTACHMENT
KEY-MAKING MACHINES.
Giant Key-Seater Co.,
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BARNES' NEW SENSITIVE DRILL
HAS THESE GREAT ADVANTAGES:
The speed can be instantly changed from 0 to 1600 without stopping or shifting belts. Power applied can be graduated to drive with equal safety, the smallest or largest drills within its range, a wonderful economy in time and great saving in drill breakage. Send for catalogue.
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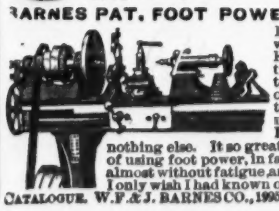
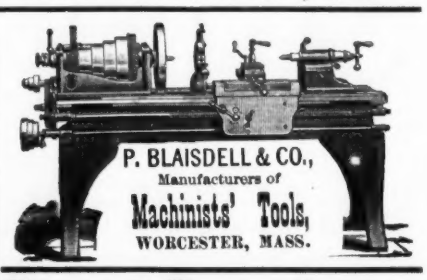


I feel so highly pleased with your Velocipede Foot Power with seat, that I wish to add my testimony to its superiority. I did not expect to like it, but having used the Velocipede Power I would have nothing else. It so greatly lessens the fatigue of using foot power, in fact, it may be said to be almost without fatigue, and is a steadier motion. I only wish I had known of it sooner. SEND FOR CATALOGUE. W. F. & J. BARNES CO., 1995 Ruby St., Rockford, Ill.



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All Sizes from 14 in. to 30 in. swing carried in stock.
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Manufacturers of
Shaping Machines, Drilling Machines, Bolt Cutting Machines.
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ESPECIALLY ADAPTED TO POINTING WIRE RODS AND WIRE FOR DRAWING.
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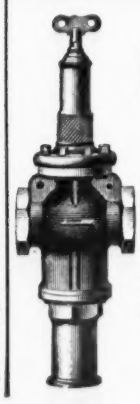

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Improved TURNTABLES for LOCOMOTIVES, CARS and PIVOT BRIDGES.
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OVER 300 SIZES.
ALSO
POWER CUSHIONED HAMMER.
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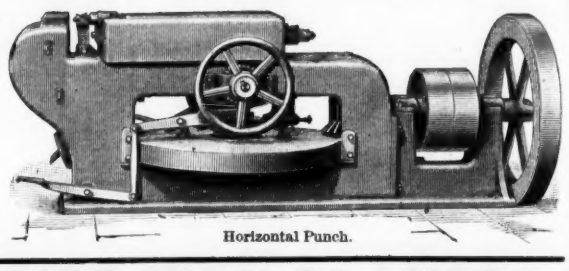
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THE OPEN SIDE IRON PLANERS.
In efficiency equal to the Standard Planers of the very best makes.
Capacity and adaptability unequaled by any metal planing tool.
Standard sizes 30 in. to 72 in. by any length.
Extension Planers 72 in. to 120 in. by any length.
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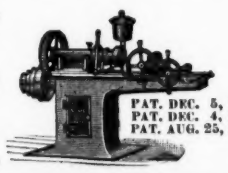
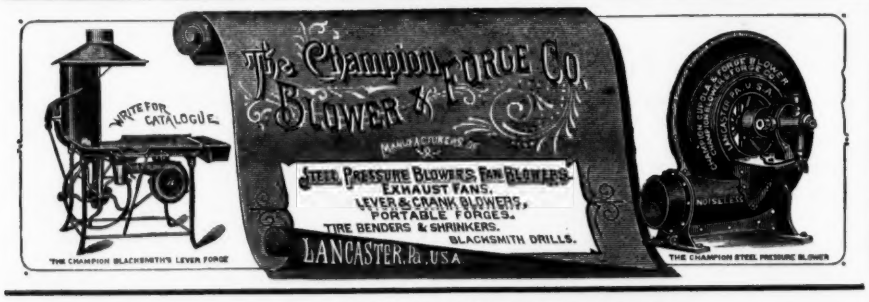
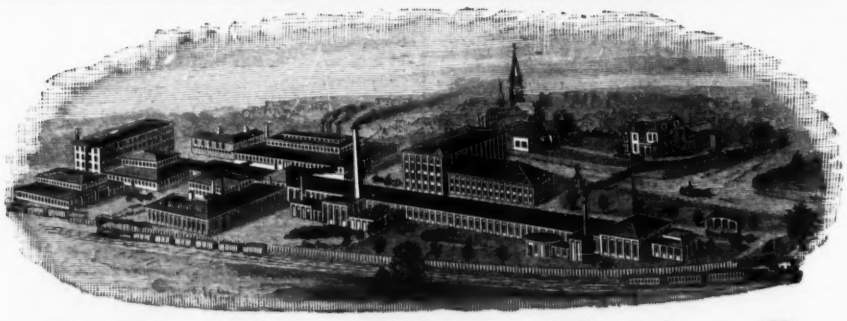
Also SEPARATE HEADS and DIES.
FIRST PREMIUM, CINCINNATI CENTENNIAL.


PAT. DEC. 5, 1882.
PAT. DEC. 4, 1883.
PAT. AUG. 25, 1885.





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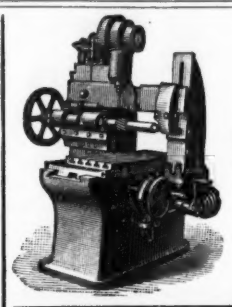

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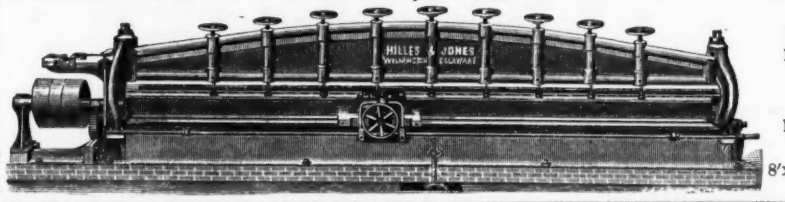

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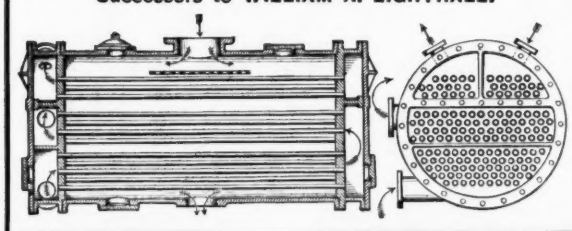

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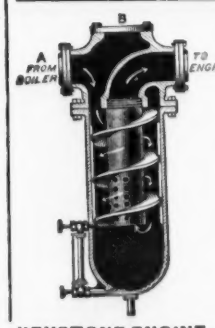

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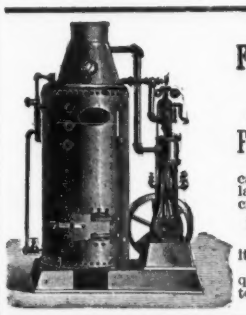

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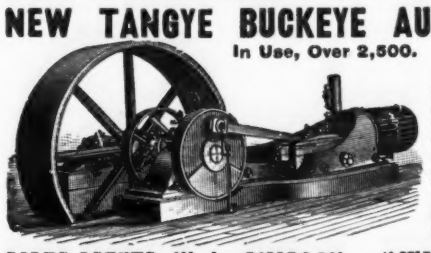

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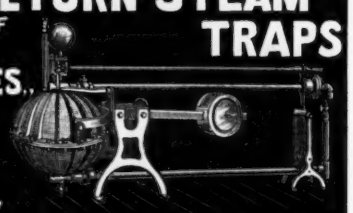

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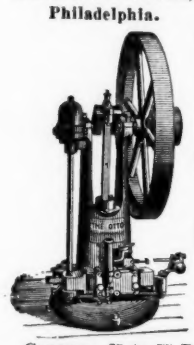

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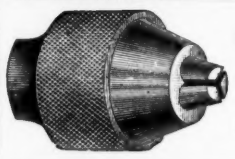

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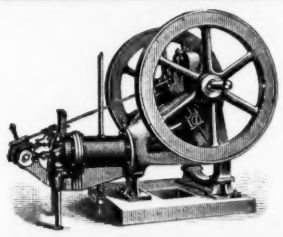

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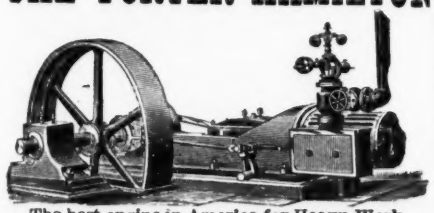

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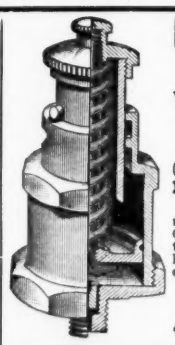

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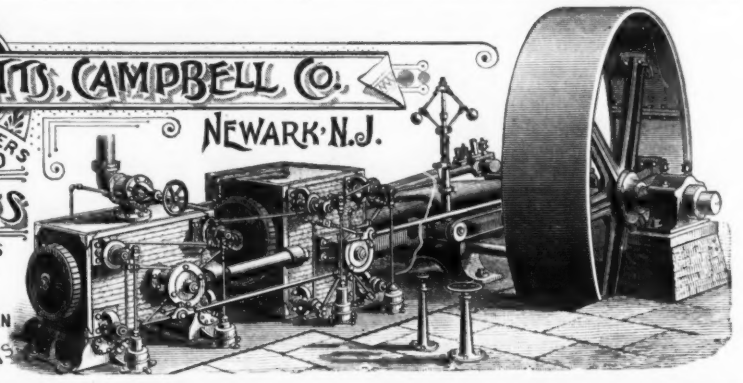

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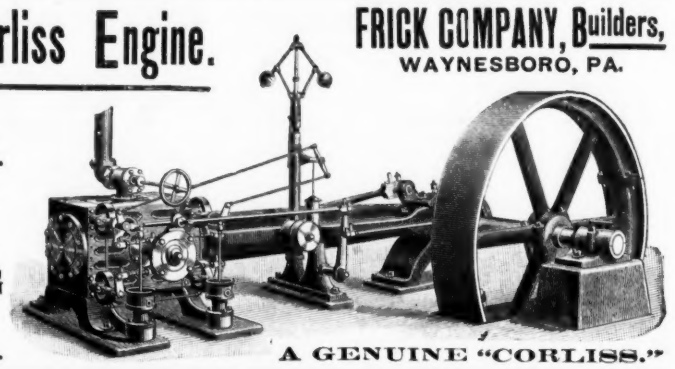

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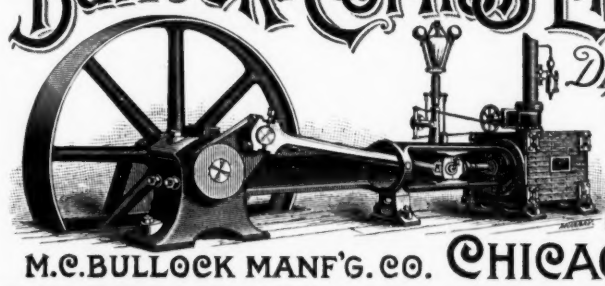

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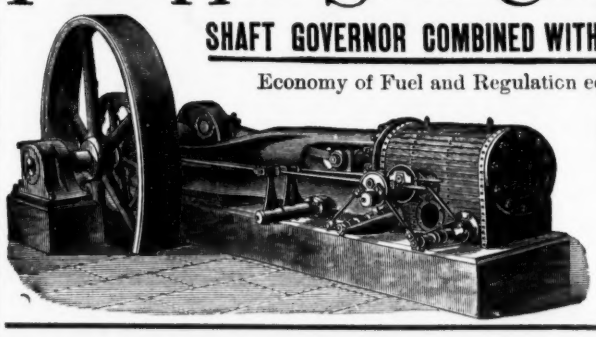

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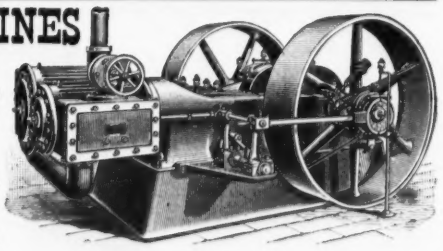

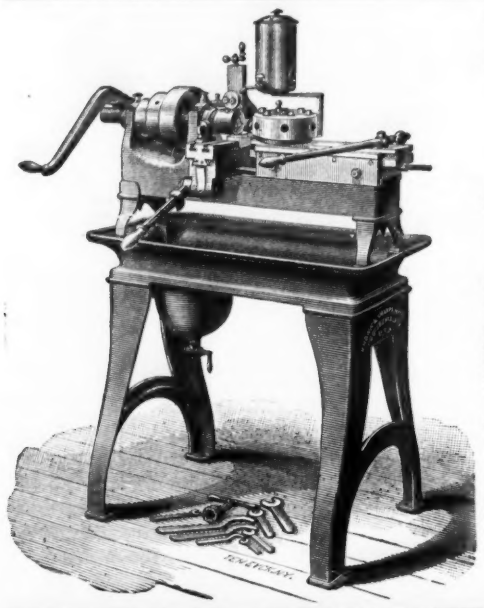

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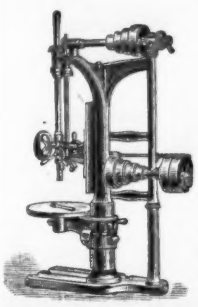

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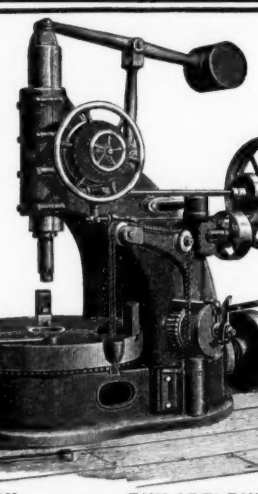

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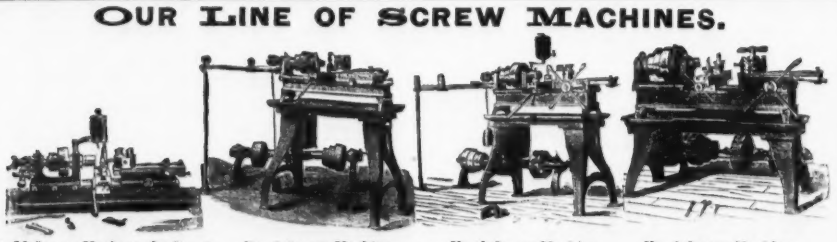

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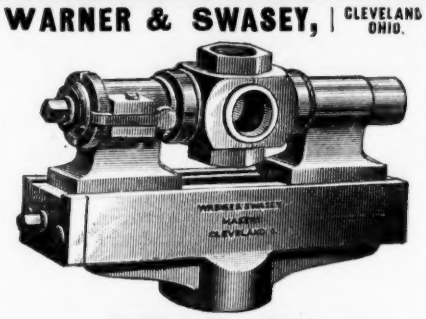

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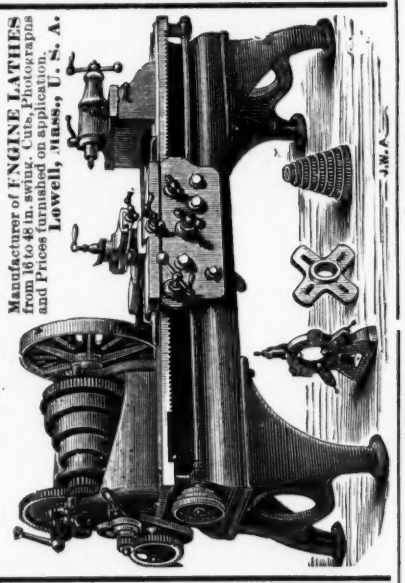

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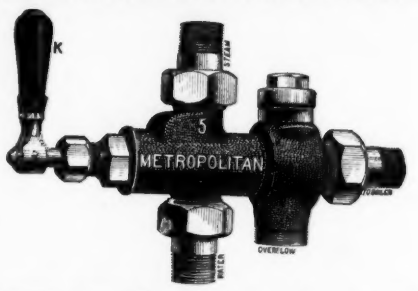

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